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Harbours.

B Y

NATHANIEL COLSON, *Student in the Mathematics.*

The whole revised, and adjusted to the NEW STYLE,
By WILLIAM MOUNTAINE, F.R.S.

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To the Ingenious MARINER.

I Here present thee with a New Calendar, wherein I have endeavoured, not to puzzle thee with unprofitable Problems, (a Thing too much practised) but to make Things plain and practicable: Here is nothing obscure or difficult to discourage young Beginners (for whom 'tis intended) but all Things treated of with as much Plainness (both as to Matter and Method) as possible; and I assure thee was I present to instruct thee, I could by no means render things more intelligible than I have here done: I have endeavoured to omit nothing that might be materially useful, having respect to the design'd bigness of the Volume. The Contents are as follow:

The Principles of Arithmetic, with which I begin, because I am sensible of the Loss some have been at, that have attempted Navigation before they have understood something of it; the Extraction of the Square and Cube Roots; In all which I have endeavoured to apply the Examples to Sea Affairs: Some necessary Geometric Problems, useful in Navigation; Directions for finding the Prime, Epact, Moon's Age, and the Time of Full Sea (both according to the ordinary and a more accurate Way) with Tables for the same.

Tables of the Sun's Place and Declination, with Directions and Examples to every Case, how to use the Declination to find the Latitude: As also the necessary Tables for correcting the Declination, when the Difference of Longitude is considerable from the Meridian of London, for which the said Tables of Declination are calculated: A Table of the Sun's Right Ascension: A Table of the Right Ascension and Declination of some of the principal fixed Stars, with the use of the said Tables in finding the time of a Star's coming to the Meridian; as also Directions at large for Observation of any of the said Stars to find the Latitude of the Place, with Examples in each Case. The Description of the Sea-Quadrant, Fore-staff and Nocturnal: A Table of Latitude and Longitude of the principal Places on the Sea-Coast, collected from the best Information, Problems in Plane Sailing and Astronomy, (which that the Practitioners might learn two things at once) are wrought both by the Logarithms, and Gunter's Scale: A large and very useful Table of Difference of Latitude and Departure to every Degree and Quarter Point of the Compass; With its use in working a Traverse in order to keep a Reckoning at Sea: A Rutter for the Coast of Great-Britain, France, Ireland, Spain, Portugal, &c. Shewing the Bearing and Distance from one Place to another: A Table of the Soundings coming into the Channel, giving the Depth of Water, and Quality of the Ground; Lastly, Directions for sailing into some principal Harbours; By all, or any of which, if thou art by any means profited (as I know thou mayest, if thou wantest Information in any of these Things, and dost but carefully animadvert upon what thou readest) I have my End; And thy kind Acceptance hereof will further oblige

Thy sincere Friend,

Nathaniel Col'lon.

*The Principles of Arithmetic briefly and plainly demonstrated,
with the Extraction of the Square and Cube Roots.*

BECAUSE of the Usefulness and Necessity of some Knowledge of *Arithmetic*, in the Art of *Navigation*, it is requisite to begin with that, without which no Progress can be made; and first of

Numeration.

Numeration is that part of *Arithmetic*, whereby one may rightly express the Value of any Number proposed.

All Numbers are expressed by these Characters following.

1, 2, 3, 4, 5, 6, 7, 8, 9, 0
One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Cypher,

Altho' Cyphers signify nothing by themselves, yet being put before (or at the Right-Hand of) other Figures, they increase their Value as much as if they were all Figures, as may plainly be seen in the Table following.

1	Units	1
12	Tens	10
123	Hundreds	100
1234	Thousands	1000
12345	X Thousands	10000
123456	C Thousands	100000
1234567	Millions	1000000
12345678	X Millions	10000000
123456789	C Millions	100000000

Figures have their Value according to the Places they are set in, as: in the first Place, or Places of *Units*, is *One*; in the second Place *Ten*; in the third Place *One Hundred*; in the fourth Place *One Thousand*; in the fifth Place *Ten Thousand*, &c.

The Table directs how properly to express any given Number; As 123 which Number consisting of three Places, is thus numbred, *One Hundred Twenty Three*; this Number 123456, consisting of six Places, is thus expressed, *One Hundred, Twenty Three Thousand, Four Hundred Fifty-six* and this Number 123456789, consisting of nine Places, is thus numbred, *One Hundred Twenty-three Millions, Four Hundred Fifty-six Thousands, Seven-Hundred Eighty-Nine.*

Addition

Addition is that which makes but one Sum of several

Example. Suppose four Men (A. B. C. D.) owe me several Sums of Money, I would know how much is due to me in the whole: I begin at the first Row towards the Right-Hand and say, 3 and 6 is 9 and 2 is 11, and 4 is 15; setting down the 5 under the Row added up; then I carry the 1 ten to the next Row, saying 1 and 4 is 5, and 5 is 10, and 3 is 13, and 6 is 19; set down 9 under the Row, added up, and carry 1 to the next row, saying 1 and 8 is 9, and 1 is 10, and 4 is 14, and 5 is 19; set down 9 and carry 1, which 1 and 1 is 2, and 3 is 5, and 5 is 10, and 3 is 13, which because this is the first row, I set down: So that by this *Addition*, the whole Debt is found to be *Thirteen Thousand, Nine Hundred, Ninety-five Pounds*.

	Pounds
A oweth	3564
B	5432
C	3156
D	1843
	13995

Exam. 2. Suppose I have several Creditors to whom I owe several Sums of Money, I desire to know the whole.

Beginning again (as before in *Addition*) at the Right-hand, I say 11 and 10 is 21, and 4 is 25, and 6 is 31; now considering how many Shillings there are in 31*d.* I find 2*s.* and 7*d.* whereof I set down the odd 7*d.* under the row of Pence, and carry the 2*s.* to the next row being Shillings, saying 2 and 4 is 6, and 8 is 14 and 9 is 23, and 11 is 34, that is 1*l.* 14*s.* set down 14*s.* and carry the 1*l.* to the next row, saying, 1 and 3 is 4, and 6 is 10, and 5 is 15, and 3 is 18; set down 8 and carry 1; then 1 and 3 is 4, and 5 is 9, and 3 is 12; set down 2 and carry 1: Lastly, 1 and 1 is 2; so that by this *Addition* the whole Debt is, *Two Hundred Twenty Eight Pounds, Fourteen Shilling and Seven Pence*.

Characters used

{ l. }	Pounds.
{ s. }	Shillings.
{ d. }	Pence.
{ ° }	Degrees.
{ ' }	Minutes.
{ " }	Seconds.

l.	s.	d.
33	11	6
55	9	4
36	8	10
103	4	11
228	14	07

Exam. 3. Suppose at Sea, keeping my Reckoning in Degrees and Minutes, having six Days Difference of Longitude, I would know how much the whole is.

Say 13 and 2 is 15, and 9 is 24, and 56 is 80 and 6 is 86; now 60 Minutes making a Degree, set down the odd 26 Minutes under the row of Minutes, and carry the 1 Degree to the next row, being Degrees; saying 1 that I carried and 1 is 2, and 1 is 3, and 2 is 5, and 1 is 6, and 1 is 7, so that the whole Difference of Longitude made these 6 Days, is 7 Degrees and 26 Minutes.

	°	'
2 Day	1	6
1	0	56
3	1	9
4	1	0
5	1	2
6	2	13
Sum	7	26

Subtraction

SUBTRACTION.

Subtraction is the taking of a less Sum out of a greater, and finding the Remainder.

Example. Suppose a Man oweth me — — — 376: 13: 6
And hath paid me — — — 211: 5: 8
I desire to know what remains unpaid, which is — — 165: 7: 10

In working this, I cannot take 8 from 6; therefore I borrow 1 Shilling from the 13, and add it to the 6 Pence, which makes 18; and say, 8 from 18, and there remains 10, which I set down under Pence; then considering there are but 12 Shillings, (because I had taken 1 away) I say 5 from 12, there remains 7, which I put down under Shillings: Or, if 1 be added to the 5, and say, 6 from 15, the Remainder will be the same; then proceeding to the Pounds, I say, 1 from 6 there remains 5, and 1 from 7 there remains 6; and lastly, 2 from 3, there remains 1: so there remains due of the said Debt, *One Hundred Sixty Five Pounds, Seven Shillings, Ten Pence.*

Example 2. Suppose the Distance between two Places to be 1000 Miles, and that I have sailed 396, and desire to know how many Miles I have to Sail.

Placing 396, under the 1000, I say, 6 from 0 I cannot, but 6 from 10 there remains 4; proceeding to the next Figure I say, 1 that I borrowed and 9 is 10, from 0 I cannot, but 10 from 10 there remains 0: Again, 1 that I borrowed and 3 is 4, from 0 I cannot; but 4 from 10, there remains 6: Lastly, 1 that I borrowed from 1, there remains 0: So there remains 604 Miles.

Example 3. Suppose one Place in the Latitude of 51 Deg. 32 Min. N. and another in the Latitude of 42 Deg. 10 Min. N. I would know the Difference of Latitude between them.

To do which, subtract the less Latitude out of the greater d. m.
thus; the lesser being placed undermost, say, 10 from 32, there 51:32
remains 22, which place under the Minutes; then for the Degrees, 42:10
2 from 1 I cannot, but 2 from 11, there remains 9; then 1 9:22
that I borrowed, and 4 is 5, 5 from 5 there remains 0.

So the Difference of Latitude is 9 Deg. 22 Min.

MULTIPLICATION.

Multiplication is that which serves instead of many Additions, by which any Number of a greater Denomination is brought into a less, as Pounds into Shillings, Shillings into Pence, and Pence into Farthings; Degrees into Minutes, Minutes into Seconds, and the like; which is done by multiplying the Number of the greater Denomination, by that number of the less which is contained in one of the greater; as the multiplying any Number of Pounds by 20 (the Number of Shillings contain'd in a Pound) brings it into Shillings, and so of the rest.

Multiplication consists of Three Parts.

1. The Multiplicand, or Number to be multiplied.
2. Multiplier, or Number by which to multiply.
3. The Product made by the Multiplication.

For the Learner's more ready Progress herein, it is necessary to insert the following Table which is first to be committed to Memory. The

MULTIPLICATION

The Multiplication T A B L E.

2 times	$\begin{Bmatrix} 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{Bmatrix}$	is	$\begin{Bmatrix} 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 18 \end{Bmatrix}$	4 times	$\begin{Bmatrix} 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{Bmatrix}$	is	$\begin{Bmatrix} 16 \\ 20 \\ 24 \\ 28 \\ 32 \\ 36 \end{Bmatrix}$	7 times	$\begin{Bmatrix} 7 \\ 8 \\ 9 \end{Bmatrix}$	is	$\begin{Bmatrix} 49 \\ 56 \\ 63 \end{Bmatrix}$
3 times	$\begin{Bmatrix} 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{Bmatrix}$	is	$\begin{Bmatrix} 9 \\ 12 \\ 15 \\ 18 \\ 21 \\ 24 \\ 27 \end{Bmatrix}$	5 times	$\begin{Bmatrix} 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{Bmatrix}$	is	$\begin{Bmatrix} 25 \\ 30 \\ 35 \\ 40 \\ 45 \end{Bmatrix}$	8 times	$\begin{Bmatrix} 8 \\ 9 \end{Bmatrix}$	is	$\begin{Bmatrix} 64 \\ 72 \end{Bmatrix}$
				6 times	$\begin{Bmatrix} 6 \\ 7 \\ 8 \\ 9 \end{Bmatrix}$	is	$\begin{Bmatrix} 36 \\ 42 \\ 48 \\ 54 \end{Bmatrix}$	9 times	9	is	81.
								10 times	10	is	100

1. I demand how many Shillings there are in 5648l.
To Answer this, multiply the given Number of Pounds by 20,
Thus; The first being 0 Cypher, set down 0 underneath the first
Figure; and then proceed to the next Figure, and say 2 times 8
is 16; set down 6 under the second Figure and carry 1; then
2 times 4 is 8, and 1 that I carried makes 9; then 2 times 6 is
12, set down 2, and carry 1; lastly, 2 times 5 is 10, and 1 that
makes 11. So that 5648l. multiplied by 20, makes 112960 Shillings.

Ex. 2. In 276 Degrees how many Minutes?

First set down 276
Then (because 60 Minutes make a Degree) multiply by 60
The Product is 16560
So that I find 276 Degrees multiplied by 60, makes 16560 Minutes.

Ex. 3. Multiply 8765437
By 32

17530874
26296311
Product 280493984

Multiply 47632867
By 4352

95265734
238164935
142898601
160531468
207298237184

DIVISION.

Division is that which serves instead of many Subtractions, and is
useful in reducing all Numbers of a lesser Denomination into a greater;
as Minutes into Degrees, Farthings into Pence, Pence into Shillings, and
Shillings into Pounds. It consists of Three Parts, (viz.) Dividend or the
Div

Number to be divided; the Divisor, or the Number to divide by; and the Quotient; also if any Number remain, it is called the Remainder.

Example 1. To divide 7834 by 23; first say, how many times 2 in 7; Or how often 23 in 78, the Answer will be 3 times, which place in the Quotient; then multiply the Divisor 23 by 3, the Figure placed in the Quotient, saying 3 times 3 is 9, and 3 times 2 is 6, place these under the two first Figures of the Dividend, and draw a Line; subtracting 69 from 78, there rests 9, which set underneath, and place a Point under 3, to shew that it is brought down; place it to the 9, then proceed, saying, how many times 23 in 93, or how many times 2 in 9, which will be 4 times; place 4 in the Quotient, by which multiply the Divisor: Again, placing the Product which is 92 under 93, draw a Line and subtract it therefrom, the Remainder 1 put under the Line, and set down 4 the last Figure in the Dividend, putting a Point under it, and place it to the Remainder 1; then because there remains but 14, being less than the Divisor 23, and so cannot be taken out of it, place a Cypher in the Quotient, and the Work is finished:

Divis.	Divid.	Quot.
23)	7834	(340
	69	
	93	
	92	
	14 Rem.	

Example 2. In 360 Minutes how many Degrees? Here I divide by 60, because 60 Minutes make a Degree, and because the last Figure of the Divisor is a Cypher, I cut it off, and with it the last Figure of the Dividend, which is here also a Cypher, and divide 36 by 6, (which is the same Thing as to divide 360 by 60) but because 6 cannot be taken out of 3, therefore I say, how many times 6 is 36? The answer is 6 times: Which I place in the Quotient, and proceed to multiply the Divisor 6, by the 6 placed in the Quotient, which produceth 36, which subtracted leaves 0; so that by this Work it appears, that in 360 Minutes there are 6 Degrees just.

Divis.	Divid.	Quot.
6 0	36 0	(6
	36	
	00	

Example 3. A Ship taken by 253 Men, is valued at 59875 l. I demand each Man's Share, being equally divided?

Divisor.	Dividend.	Quotient.	
253)	59875	(236	253
	506		236
	927		1518
	759		759
	1685		506
	1518		167
	167 Remains		Proof 59875

First, say, how many times 2 in 5? The answer is two times, which place in the Quotient; then multiply the Divisor 253 by 2, the Figure placed in the Quotient, saying 2 times 3 is 6, 2 times 5 is 10, set down 0, and carry 1; 2 times 2 is 4, and 1 is 5, which set down under the 3 first Figure

Figures of the *Dividend*, from whence being subtracted, set the Remainder underneath, which will be 92, then take down 7, making a Point underneath, and set it after 92, the Remainder; then say, how often 2 in 9? Answer 3 times (for 4 will prove too many.) Then multiply the *Divisor* 253, as before, by 3, the Figure last placed in the Quotient, and the Product will be 759, which being subtracted from the Figures above, the Remainder will be 168, then take down 5, and point it as before, setting it after 168, the last Remainder: And again, ask the Question how often 2 is contained in 16? Answer 6 times; by which 6, which set in the Quotient, multiply the *Divisor* 253; and the Product is 1518, which place under the last *Dividend*, and subtract therefrom, there will remain 167. So there being no more Figures to bring down, the Work is finished, each Man's Share being 236 *l.* and 167 *l.* over, which is to be divided among them; which may easily be done by multiplying 167 by 240, and dividing the Product by 253, give each Man's Share in Pence. The Proof is by multiplying 253 the *Divisor* by 236 the *Quotient*; then taking in 167 the Remainder, under the 3 last Figures, the Product will make the same with the *Dividend*, as you see in the Operation.

The Rule of THREE,

I S that which having three Numbers given, a fourth Number is found in Proportion thereunto; which is done by multiplying the 2d and 3d Numbers together, and dividing that Product by the first, and the Quotient of the said Division is the Answer to the Question.

Example 1. If in 24 Hours a Ship sails 130 Miles; how many Miles will she sail with the same Gale in 192 Hours or eight Days;

Hours	Miles	Hours
24	130	192
		130
24)24960(1040 Miles in 192 Hours		5760
24		192
96		24960
96		
00		

Here 24 is the first Number, 130 the second, 192 the third; wherefore according to the Rule, I multiply 130 and 192 the second and third Numbers together, and divide the Product thereof 24960, by 24 the first Number, which gives in the Quotient 1040 Miles, which is the Way the Ship will make in 192 Hours, the Time proposed.

Example 2. If 1 lb. of Tobacco cost 6d. what will 112 lb. cost?

$$\begin{array}{r} 112 \\ 6 \\ \hline 12)672 \text{ Pence (or 56 Shillings.)} \end{array}$$

Here the first Number being an Unit, which neither multiplies nor divides, it saves the Labour of Division; and the Answer is 672 *d.* for the Answer

The Rule of THREE.

11

Answer will be of the same Name with the second Number, which divided by 12 to bring them into Shillings, gives the Quotient 56 s. which is the Price of 112 lb. as required.

Example 3. If a Staff of 3 Yards long, give a Shadow of 2 Yards: How high is that Castle whose Shadow is 100 Feet?

Which Question for the more ready Solution, state thus:

If 6 Feet (which is two Yards) give 9 Feet, what will 100 Feet give?

By the Operation it appears the said

Castle must be 150 Feet high.

$$\begin{array}{r} 9 \\ 6 \overline{) 900} \text{ (150 Feet)} \\ \underline{6} \\ 30 \\ \underline{30} \\ 0 \end{array}$$

Example 4. If 564 l. 12 s. 6 d. is to be divided amongst 165 Men, how much is one Man's Share.

First, Reduce it all into Pence, by multiplying 564 by 20 (the Shillings in one Pound) adding the 12 Shillings makes the Product 11292, which multiply by 12 (the Pence in one Shilling) and add the 6 Pence, the Product 135510 is the Pence in 564 l. 12 s. 6 d. Then say,

If 165 Men have 135510 Pence, how many shall one Man have? And here you should multiply 135510 by the last Number, but in this Case it is 1, which will neither multiply nor divide, therefore you only divide 135510 the Sum of Pence, by 165 the Number of Men, and the Quotient 821 is the Pence for each Man's Share, which divided by 12 (the Pence in one Shilling) gives 68 Shillings, and the 5 Remaining are 5 Pence to each Man's Share.

Note, The 45 Remaining of the first Division is only $\frac{4}{12}$ of one Penny, which is little more than a Farthing.

The Operation follows.

564 l. 12 s. 6 d.

$$\begin{array}{r} 20 \\ \hline 11292 \\ 12 \\ \hline 22590 \\ 11292 \\ \hline 165 \overline{) 135510} \text{ (821 Pence)} \\ \underline{132000} \\ 3510 \\ \underline{3300} \\ 2100 \\ \underline{1650} \\ 450 \end{array}$$

$$\begin{array}{r} 12 \overline{) 821} \text{ (68 Shillings, equal} \\ \underline{72} \text{ to 3 l. 8 s. 5 d.)} \\ 101 \\ \underline{96} \\ 5 \end{array}$$

Note,

The Extraction of the Square Root.

Note, That in the *Rule of Three*, the first and third Numbers must be both of one Denomination, and the second must be brought into the lowest Value expressed therein; as in the foregoing Example, I work not the Question as it was first stated, but transposing the Numbers, I put the Denomination of Men first and last, and the Money in the Middle, to answer to that Part of the Rule, which requires the first and third Numbers to be both of one Name. The Answer whereof in the preceeding Question, as by the Operation appears, is 821 Pence; which reduced into Shillings, is 68 s. and 5 d. or 3 l. 8 s. 5 d. one Man's Share, as was required.

The next thing I shall briefly treat of is, *The Extraction of the Square and Cube Roots*, as also somewhat of their Use.

The Extraction of the Square Root.

Ex. 1. **T**O Extract the Square Root of 7056 proceed thus: First, Point the given Number (that is, put a Prick over every other Figure, beginning at the first Figure at the Right-hand) and note by the Way, that so many Points as the said Number admits over it, of so many Figures consists the Root of the said Number; then proceed, seeking the greatest Square Number (which is a Number multiplied by itself) in the first Point towards the Left-hand (70) which is 64, constituted of 8 multiplied into itself; for 8 times 8 is 64. The Root of the Square Number which is 8, place in the Quotient, and subscribe the Square Number (64) under the said first Point, subtracting it therefrom, and setting down the Remainder (6) underneath: To this Remainder bring down the next Point (56) then drawing a crooked Line on the Left-hand of the Dividend (656) double the Root 8, last found and place it (*viz.* 16.) therein calling it the Divisor, seek how often the Divisor is contained in all the Figures of the Dividend, save the last to the Right-hand: (*viz.*) How many times 16 in 65? The answer is 4 times, which place after the 8 in the Root, and also on the Right-hand of the Divisor (16) then multiply the Divisor (164) by the 4 last placed in the Root, and put the Product, which is 656, under the Dividend, subtracting it therefrom; which done, nothing remains: So that the Square Root of 7056 is 84.

$$\begin{array}{r}
 7056(84 \text{ Root} \\
 \underline{64} \\
 164)656 \text{ Divisor.} \\
 \underline{656} \\
 000
 \end{array}$$

The Square Root is applied to Navigation as follows:

Any two Sides of a Right-angled Plane Triangle being given, the third is found by the Extraction of the Square Root.

Example 2. Suppose a Ship hath made 87 Miles Difference of Latitude, and 71 Miles Departure, and the Distance is required, the said Distance is found by the Extraction of the Square Root, as follows:

The Rule. Square the Difference of Latitude and Departure severally (that is, multiply each by itself) add these two Squares together, and extract the Square Root of this Sum, which will be the Distance required.

Example

Example.

Difference of Lat. 87	The Departure 71	Square Diff. Lat. 7569
Multiplied by itself 87	Multip. by itself 71	Square Departure 5041
<u>609</u>	<u>71</u>	<u>their Sum 12610</u>
696	497	

The Square = 7569 The Square = 5041
 12610 (112 the Distance req.

By the Operation it appears, that the Distance, omitting the Fraction, is 112 Miles.

$$\begin{array}{r} 112 \\ 21 \overline{) 26} \\ \underline{21} \\ 222 \overline{) 510} \\ \underline{444} \\ 66 \end{array}$$

Example 2. Suppose a Ship's Distance to be 111 Miles, her Departure 57 Miles, and the Difference of Latitude to be required; the said Difference of Latitude is found by the Extraction of the Square Root, as follows.

The Rule. From the Square of the Distance subtract the Square of the Departure, and the Square Root of the Remainder will be the Difference of Latitude required.

<i>Example.</i> The Distance ——— 111 Multiplied by itself ——— 111 <u>111</u> 111 111 <u>111</u>	The Departure = 57 Multiplied by itself = 57 <u>399</u> 285 <u>Sq. of Departure = 3249</u>
--	---

Square of the Distance ——— 12321 Square of Dep. subtract ——— 3249 Remains ——— 9072	9072 (95 Diff. Lat. required $\begin{array}{r} 189 \overline{) 972} \\ \underline{925} \end{array}$
--	--

The Difference of Latitude, as by the Operation appears, is 95 Miles, omitting Fractions.

If the Departure be required, the Rule is, from the Square of the Distance, subtract the Square of the Difference of Latitude, and the Square Root of the Remainder is the Departure required. The Operation for Brevity-sake is omitted.

Having proceeded thus far in shewing the *Practitioner* how to find the Distance, Difference of Latitude and Departure (any two of them being given, without Trigonometry) I shall shew the Manner of finding the Course exact enough for common Use, without the said Operation, which is done as follows.

The Proportion to find the Course, As the Sum of the Hypotenuse (or Distance) and half the greater of the other two Legs (viz.) of the Difference of

of Latitude if it be most, half that, but if the Departure be most, half that; I say; As the Sum of these two, is (in Proportion) to the lesser (or remaining) Leg; so is 86, to the Angle (in Degrees) opposite to the less Leg; which is the Course, when the Departure is less than the Difference of Latitude, otherwise 'tis the Complement of the Course.

Example. Admit a Ship's Distance to be 110; the Difference of Latitude to be 88, and the Departure 66, and the Course required.

First, Add the Distance, and half the greater Leg into one Sum.

The Distance is _____ 110

Half the greater Leg (88) is _____ 44

The Sum _____ 154

Having thus done, say, by the Rule of THREE.

As the said Sum 154, is to 66 the lesser Leg; so is 86, to the Course.

To bring out the odd Minutes, multiply the Remainder of the Division 132 by 60, (the Number of Min. contained in a Degree) and divide the Product by the Divisor (154) and the Quotient of the said *Division* gives for the Answer 51 Minutes: So that the Course required is 36 deg. 51 min.

$$\begin{array}{r}
 66 \\
 \hline
 516 \\
 516 \\
 \hline
 154 \overline{) 5070} (36 \text{ deg. } 51 \text{ min.} \\
 \underline{462} \\
 1056 \\
 \underline{924} \\
 1320 \\
 \underline{1132} \\
 220
 \end{array}$$

Example 3. Extraction of the Square Root. Suppose a Rope 5 Inches Compass, and another Rope of double the Strength is required. The Dimensions of the said required Rope are found by the *Extraction of the Square Root*: For should it be supposed that a Rope of 10 Inches Compass, is but double the Strength of a Rope of 5 Inches; upon Proof it is manifestly false, for the said Rope of 10 Inches is 4 times the Strength of that of 5.

The Rule. Take the Compass of the given Rope, (*viz.* 5.) and multiply that by itself; which Product (because the other Rope is to be twice as strong, multiply by 2, and the Square Root of the Product is the Compass of the Rope required.

Example. The given Rope's Compass 5 Inches.

Multiplied by itself _____ 5

The Square _____ 25

Multiplied by _____ 2

50

Extract the Root 50(7

49

So by this Operation it appears that a Rope must be 7 Inches and a little better, to be twice the Strength of the given Rope of 5 Inches Compass.

If it's desired to know the Weight of one Rope by another, 'tis as follows.

The Proportion is, As the Square of the Compass of the one Rope is to the Square of the Compass of the other; so is the Weight of the one to the Weight of the other, Length for Length. *Ex.* Suppose a Cable of 10 Inch. to weigh 25 Hundred, and the Weight of a Cable of 8 Inches required. Say,

as

Extraction of the Cube Root.

15

as 100 (the Square of 10) is to 64 the Square of 8: So is 25 C. the Weight of one Cable to 16 C. the Weight of the other required.

Extraction of the Cube Root.

I Shall first, as necessary, insert a Table of the Cubes of the Nine Digits, which ought to be committed to Memory.

Cube of the Nine Digits.	1	—	1	—	64	7	—	343
	2	—	8	—	125	8	—	512
	3	—	27	—	216	9	—	729

Example 1. Extract the Cube Root of 12167.

First, Point the given Number, (*i. e.*) put a Prick over every third Figure (beginning at the Right-hand) then seek the greatest Cube in the first Point, (*viz.* 12) which is 8, the Cube Root whereof (which is 2) place in the Root; subtract the Cube (8) from the first Point (12) place the Remainder underneath; to this Remainder bring down the next Point (167) and call this the Resolvend, then draw a Line underneath it, then square the Quotient 2, which is 4; multiply the said Square (4) by 300, which makes 1200; place this under the Resolvend, and call it the Triple Square. Again, multiply the Quotient (2) by 30, which makes 60; place this under the Triple Square, and call it the Triple Quotient; add these two (*viz.*) Triple Square and Triple Quotient into one Sum, and call it the Divisor; seek how often this Divisor is contained in the Resolvend, which is three times; which 3 placed in the Quotient, multiply the Triple Square by the Figure 3 last placed in the Quotient and subscribe the Product underneath the Divisor; square the said Figure (3) last placed in the Quotient, and thereby multiply the Triple Quotient, and place it underneath the last Product; Cube the Figure (3) last placed in the Quotient, and place it under the preceding Product. Lastly, add these three Products into one Sum, subtracting the said Sum from the Resolvend, subscribe the Remainder; to which Remainder, had there been any more Figures, the next Point must have been brought down, and the preceding Work repeated from the squaring of the Quotient, until all the Figures are so brought down; but in this Example there being no more Figures, the Work is done, and by the Operation the Cube Root of 12167 appears to be 23, nothing remaining.

Example 2. Suppose a Ship of 300 Tun, 75 Feet by the Keel, 27 Feet and an half by the Beam, and 14 Feet Depth in the Hold; another Ship is desired of the same Mould and Shape of 500 Tuns; the several Dimensions of the Ship are found by the Extraction of the Cube Root.

First. Beginning with the Keel. Cube the Length of the given Keel, which is done by multiplying it into itself, and then multiplying the Product by it again.

The

Then say by the Rule of Three: As 300 Tuns the one Ship's Burthen, to 500 Tuns the other Ship's Burthen; so is 421875 the Cube of one Ship's Keel's Length, to the Cube of the other Keel's Length; Which being wrought by the Rule of Three, gives 703125: From which extract the Cube Root, and that will be the Length of the Keel required.

In this Extraction three Cyphers are added to bring out the Fraction, the Work therewith being the same as if there had been more Figures in the proposed Number; the Operation gives for the Length of the Keel required 88 Foot $\frac{2}{10}$ Parts.

Thus, having found one of the Dimensions, the rest may be found without the Extraction of the Root, by the Rule of Three.

Thus, suppose the next Thing I would find be her Breadth by the Beam, say, as the Length of the one Ship's Keel 75, is to the Length of the other 89 *fere*; so 29 $\frac{1}{2}$ Feet the Breadth of the one Ship by the Beam, to the Breadth of the other, which by the Rule of Three, gives 35 Feet. In the same manner you may find the Depth in the Hold, &c.

Example 3. Suppose an Iron Shot 4 Inches Diameter to weigh 9 lb. and the Diameter of a Shot of any other Weight, suppose of 72 lb. required. This is also done by the Extraction of the Cube Root, as follows:

First, say, by the Rule of Three:

As 9 lb. the Weight of one Shot, to 72 lb. the Weight of the other; so is 64 the Cube of the one Shot's Diameter, to the Cube of the other Shot's Diameter, which by the Operation is 512, the Cube Root of which is 8, the Diameter of the Shot required.

But if it was required to find the Weight of a Shot by the Diameter, 'tis done thus, by the Rule of Three.

As the Cube of one Shot's Diameter to the Cube of the other; so is the Weight of the one Shot, to the Weight of the other required?

And thus much for the *Arithmetical Part* of this Treatise.

75 given Keel
75

375
525

5625
75

28125
39375

421875 Cube given Keel

703125 (88 $\frac{2}{10}$ Root
512

191125 Resolvend

19200 Triple Square
240 Triple Quotient

19440 Divisor

153600
15360
512

169472

21653000 Resolvend

2323200 Triple sq.
2640 Trip. Quot.

2325840 Divisor

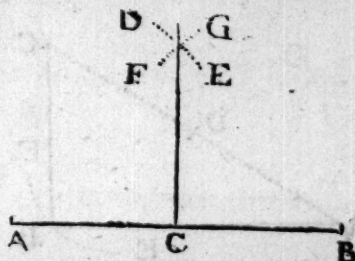
20908800
213840
729

21123369

52631 Remainder

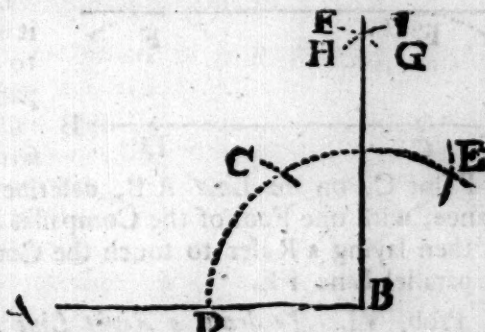
Prob. I. To raise a Perpendicular from any Point proposed, in a given Right Line.

Let the Line given be AB , and the Perpendicular to be raised from the Point C ; to do which set off the two equal Distances CA and CB . Then the Compasses being opened to any convenient Distance bigger than AC or CB , with one Foot of the Compasses in the Point A , describe the Arch DE ; then with the same Extent, and one Foot in the Point B , describe the Arch FG , then draw the Perpendicular from the Point C , thro' the Intersection, (or cutting) of the two Arches FG and DE , which was required.



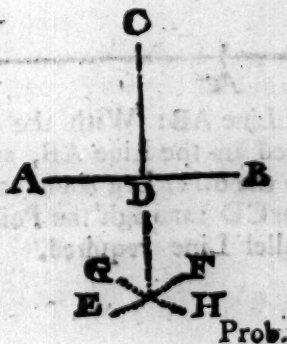
Prob. II. To raise a Perpendicular on the End of a Line.

Let the Line given be AB , the Perpendicular to be raised from the Point B ; to do which, with one Foot of the Compasses at B , with any convenient Distance, as BD , sweep an Arch; then with the same Extent, one Foot of the Compasses being in the Point D , mark the said Arch at the Point C , and one Foot being at C , mark it at E , then with the same Distance, one Foot of the Compasses being in the Point C , describe the Arch FG ; and placing the Compasses in the Point E , describe the Arch HI ; then from the Point B , and through the Intersection of the two Arches FG and HI , draw the Perpendicular which was required.



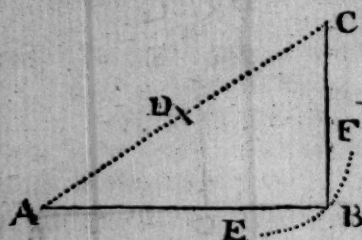
Prob. III. To let fall a Perpendicular from a Point assigned, over a given Right Line.

Let AB be the Line given, C the Point over the Line from which the Perpendicular is to fall; to do which, place one Foot of the Compasses in the Point C , then opening them to a convenient Extent, mark the Line AB in two Points with the said Distance, as in the Points A and B ; then with one Foot of the Compasses in the Point A , describe the Arch EF , and with one Foot in the Point B , describe the Arch GH ; then from the Point C , and through the Intersection of the said two Arches, draw the Perpendicular CD , which was required.



Prob.

Prob. IV. *Another way to let fall a Perpendicular from a given Point, on a given Right Line.*



Let the Line given be AB, upon which it is required to let fall a Perpendicular from the Point C; to do which, from the Point assigned C, draw the Line CA; which Line divide into two equal Parts, as in the Point D; then one Point of the Compasses resting in the Point D, with the same distance, (*viz.* of half the Line AC) describe the Arch EF: Then from the Point

C, to the Intersection of the Arch EF with the Line AB, draw the Perpendicular CB.

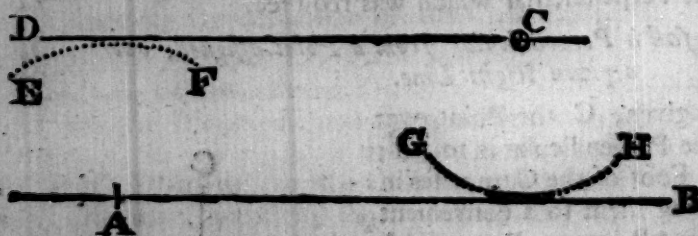
Prob. V. *To draw a Line parallel to a Line given.*



Let AB be a Line given, to which it is required to draw a Line parallel, to do which, first take in the Compasses the distance at which the parallel Line is to be drawn, and then setting one Foot of the Compasses in the Point C, on the Line AB, describe the Arch E; and with the same distance, with one Foot of the Compasses in the Point D, describe the Arch F; then laying a Ruler to touch the Convexity of the two Arches, draw the parallel Line FE.

Prob. VI. *To draw a Right Line Parallel to a given one, that shall pass through a Point given.*

Suppose AB the given Line, and it's required to draw a Line Parallel thereto, that shall pass thro' a given Point, as C.

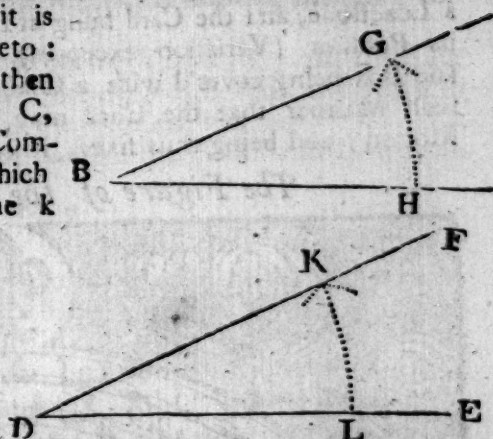


Set one Foot of the Compasses in the Point C, and the other so far, as being turned about it may describe an Arch GH just to touch, but not cut the Line AB: With the same Extent of the Compasses and one Point placed in the Line AB, at a convenient Distance from B, suppose in A, turn the other Leg about and describe an Arch EF, then with a Ruler draw Line CD through the Point C to touch the Arch EF, and it will be the parallel Line required.

PROB

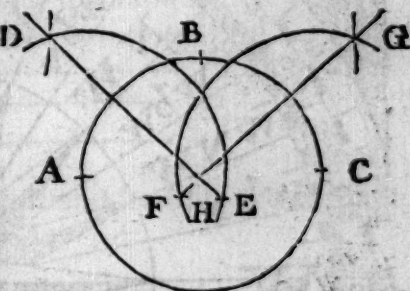
PROB. VII. To make an Angle equal to any Angle given.

Suppose BAC an Angle given, and it is required to make another Angle equal thereto: to do this, first draw the Line DE, then with any convenient Distance less than AC, describe the Arch GH, then placing the Compasses at D, with the same Distance which described the Arch GH, sweep the Arch KL, take the Arch GH in the Compasses, and setting one Foot in the Point L, cross the Line DE in the Point K, then through Point K draw the Line DKF, then is the Angle EDF equal to the Angle BAC, as was required.



Prob. VIII. To bring any three Points not situate in a Right Line, into the Circumference of a Circle.

Let the three Points thro' which the Circle to pass be A, B, C: Take above half the Distance between the two Points A and B in the Compasses; one Foot of the Compasses being in the Point A, with the said Distance describe the Arch ED; with the same Distance, one Foot of the Compasses being in the Point B, mark the Arch ED in the Points E and D, and draw the Right Line DE; then take above half the distance between the Points C and B in the Compasses, and one Foot of the Compasses being in the Point C, with the said Distance describe the Arch FG; and with the same distance, one Foot of the Compasses being in Point B, mark the Arch FG, in the Points F and G, and draw the Right Line FG. Now where the two Right Lines DE and FG, being continued, intersect each other (*viz.* in the Point H) is the Center of the Circle required.

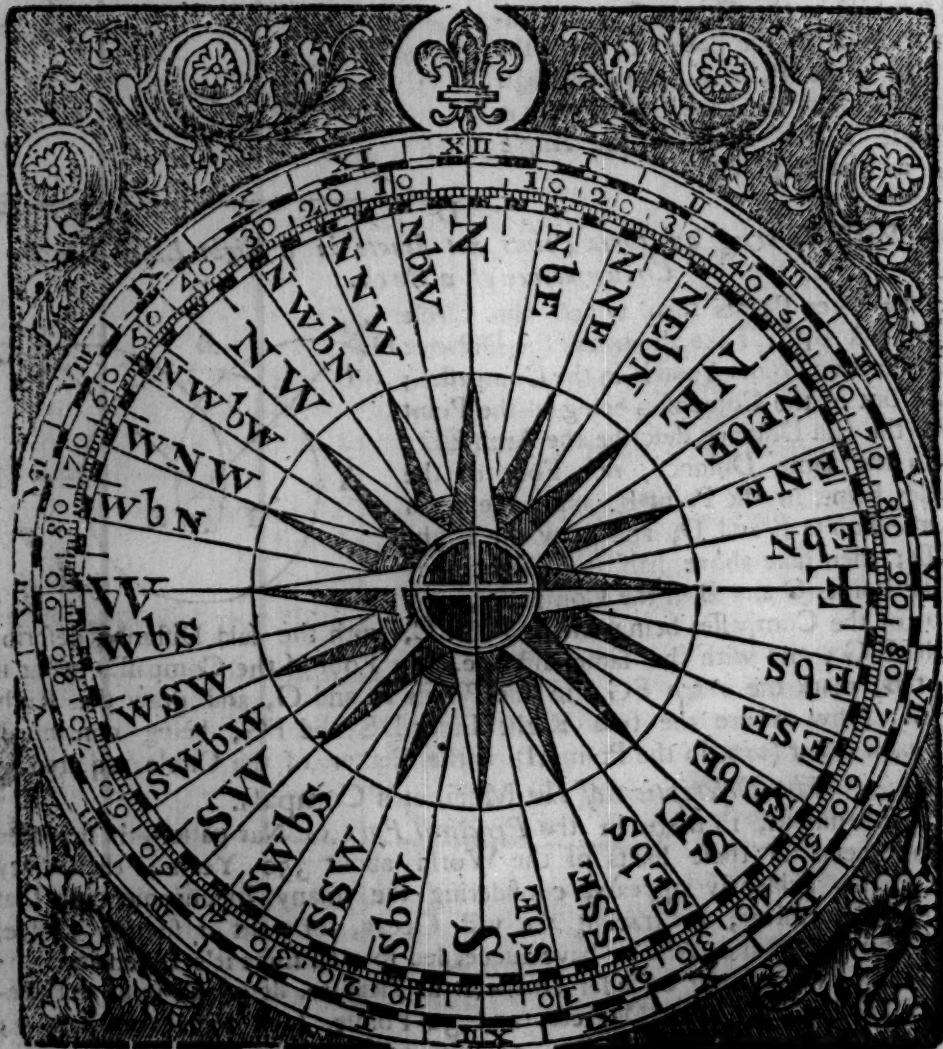


The Description of the Mariner's Compals.

THIS Instrument, so useful in the *Practical Part* of Navigation, is supposed to have been in these Parts of the World about 350 Years; the Utility thereof to us evidently appears, considering the many Inconveniencies that attended our Ancestors, in tracing the vast Ocean, for want of such a Guide, which our Maritime Affairs have succeeded so well since it's Invention. It is a Circle of a greater or lesser Diameter at Pleasure, described upon a Pasted, and divided into 360 Degrees, and 32 Points, (and sometimes into 24 Hours) each Point containing 11 deg. 15 min. or 3 quarters of an Hour; as in the following Figure. The Circle being thus divided upon the Card or Pasted-board

board, there are pasted on the other Side of the said Card or Passe-board, two hardened Wires, or a thin Bar of Steel, which being touched with a Loadstone, and the Card hung at the Center upon a Pin, fix'd in a Box, its Position (Variation excepted) becomes North and South; and the said Box being cover'd with a Glass, is hung in another square Box, in such Manner that the Card may traverse notwithstanding the Ship's Motion; and being thus fixed, it is ready for Use.

The Figure of the Mariner's Compass.



To find the Prime or Golden Number.

THE Prime or Golden Number, is a Revolution of Nineteen Years, in which Term the Moon returns to make the same Aspects with the Sun on the same Day of the Month (most commonly) that they were on Nineteen Years before.

The Gregorian, or New Calendar.

21

To find which, add 1 to the Year of our Lord, and divide by 19, the Remainder is the Prime or Golden Number, but if nothing remains, the Prime is 19.

Example. To find the Golden Number for the Year 1787, add 1, which makes 1788; which divided by 19, the Quotient will be 94, and the Remainder 2, which is the Golden Number for the Year 1787.

N.B. The Golden Number is the same in both the Julian and Gregorian Account of Time.

To find the Epact.

THE Epact is the Number of Days which the Solar Year consisting of 365 Days, exceeds the Lunar (or twelve Revolutions of the Moon to the Sun) containing 354 Days, the Difference being 11 Days. When the Prime is 1, the Epact is 0; when 2, the Epact is 11; when 3, twice 11, or 22; when 4, thrice 11, or 33, but omitting 30, (which must constantly be done when it exceeds 30;) it is 3, and may be found in the following Manner.

Subtract 1 from the Prime, Multiply the Remainder by 11, and divide that Product (if it exceeds 30) by 30; the Remainder will be the Epact.

Example. Suppose it was required to find the Epact for the Year 1787.

The Prime (or Golden Number) for the Year is	2
Subtract	1
Remains	1
Multiplied by	11
Gives the Epact for that Year	11

Note, After the Year 1799, there will require a different Method to find the Epact

To find the Moon's Age.

ADD to the Epact for *March* 1, for *April* 2, for *May* 3, for *June* 4, for *July* 5, for *August* 6, for *September* 7, for *October* 8, for *November* 10, for *December* 10, for *January* 0, for *February* 2.

Take the Epact, the Number for the Month, according to the Rule foregoing, and the Day of the Month, for which the Moon's Age is required: These three Sums added together, if less than 30, is the Moon's Age; if more than 30, then divide it by 30, the Remainder is the Age of the Moon. The Moon's Age subtracted from 30, leaves the Day of the Change. Again, 15 added to, or subtracted from the Day of the Change, leaves the Day of Full Moon.

Example. Suppose it was required to find the Moon's Age for the first Day of *April*, 1787.

First set down the Epact for that Year	11
To which add the Number of the Month	2
And the Day of the Month	1
The Sum, gives the Moon's Age	14
Deducted from 30, gives 16, the Time to next Change	16

30

The Gregorian, or New Calendar.

To find the Moon's Southing, and Time of Full-Sea, or High-Water. The Reader is here referr'd to the Tide-Table, Page 32, &c. and the Use thereof immediately following.

To find the Dominical Letter.

Divide the Year and its fourth Part by 7, the Remainder subtracted from 7 gives the Dominical Letter; reckoning A for 1, B for 2, C for 3, D for 4, E for 5, F for 6, G for 7, or 0.

Suppose it was required to find the Dominical Letter for the Year 1786

First, Set down the Year	_____	1787
Then the 4th Part, neglecting the Remainder	_____	446
The Sum divided by	_____	7)2232(318
		21
		13
		63
		56
		6

The Remainder 6, being subtracted from 7, leaves 1 or A, the Dominical Letter.

N.B. After the Year 1799, the Order of the Dominical Letters, as the now range, will be disturbed, and consequently to find them, another Method must then take Place.

To find the Cycle of the Sun.

Suppose it be required for the Year	_____	1787
Then add	_____	9
Divided by	_____	28)1796(64

Divided by 28 it quotes 64, and 4 Remains, which is the Cycle of the Sun for 1787.

Note, *Hillary* Term begins *Jan.* 23. and ends *Feb.* 12.

Easter Term begins 17 Days after *Easter-day*, and ends *Monday* before *Whitsunday*.

Trinity Term begins on *Friday* after *Trinity Sunday*, and ends nineteen Days after.

Michaelmas Term begins *November* 6, and ends *November* 28.

T A B L E S

OF THE

M O O N ' s A G E ,

From the Year 1784, to 1789.

TOGETHER WITH A

C A T A L O G U E ,

OF THE

M E A N N E W M O O N S ,

From 1790 to 1799 inclusive.

Months	D	H.	Months	D	H.
January	Full moon	7 2 A	July	Full moon	3 1 M
	Last quart.	5 5 A		Last quart.	9 3 A
	New moon	22 10 M		New moon	17 9 M
	First quart.	29 6 M		First quart.	25 1 A
Febr.	Full moon	6 10 M	August	Full moon	1 7 M
	Last quart.	14 5 M		Last quart.	7 11 A
	New moon	20 9 A		New moon	16 1 M
	First quart.	27 11 A		First quart.	23 11 A
March	Full moon	7 4 M	Septem.	Full Moon	30 3 A
	Last quart.	14 3 A		Last quart.	6 2 A
	New moon	21 7 M		New moon	4 5 A
	First quart.	28 5 A		First quart.	22 9 M
April	Full moon	5 7 A	October	Full moon	28 11 A
	Last quart.	12 10 A		Last quart.	6 5 M
	New moon	19 6 A		New moon	13 9 M
	First quart.	27 1 A		First quart.	1 5 A
May	Full moon	5 7 M	November	Full moon	28 11 M
	Last quart.	12 3 M		Last quart.	5 1 M
	New moon	19 6 M		New moon	14 1 M
	First quart.	27 7 M		First quart.	19 10 A
June	Full moon	3 5 A	December	Full moon	26 11 A
	Last quart.	10 9 M		Last quart.	10 A
	New moon	17 6 A		New moon	12 7 A
	First quart.	25 10 A		First quart.	19 8 M
				Full moon	26 3 A

Four Eclipses this Year, two of the Sun, and two of the Moon.

The first is of the Sun, February the 20th, invisible.

The second is of the Moon, March the 17th, 4 Digits, visible.

The third is of the Sun, August the 16th, invisible.

The fourth is of the Moon, August the 30th, invisible.

Months	D	H.	Months	D	H
January {	Last quart.	3 7 A	July {	New moon	6 1 A
	New moon	11 2 M		First quart.	14 1 A
	First quart.	17 5 A		Full moon	21 11 A
	Full moon	25 9 M		Last quart.	28 3 A
Feb. {	Last quart.	2 2 M	August {	New moon	5 1 M
	New moon	9 1 A		First quart.	13 6 M
	First quart.	16 4 M		Full moon	20 8 M
	Full moon	24 4 M		Last quart.	26 10 A
March {	Last quart.	4 5 M	September {	New moon	3 5 A
	New moon	10 10 A		First quart.	11 8 A
	First quart.	17 6 A		Full moon	18 4 A
	Full moon	25 10 A		Last quart.	25 8 M
April {	Last quart.	2 4 A	October {	New moon	3 10 M
	New moon	9 8 M		First quart.	11 9 M
	First quart.	16 10 M		Full moon	18 1 M
	Full moon	24 2 A		Last quart.	24 11 A
May {	Last quart.	2 1 M	November {	New moon	2 8 M
	New moon	8 4 A		First quart.	9 8 A
	First quart.	16 3 M		Full moon	16 11 M
	Full moon	24 4 M		Last quart.	23 5 A
	Last quart.	31 6 M	December {	New moon	1 9 A
June {	New moon	7 2 M		First quart.	9 5 M
	First quart.	14 8 A		Full moon	15 11 A
	Full moon	22 3 A		Last quart.	23 3 A
	Last quart.	29 11 M		New moon	31 1 A

Two Eclipses this Year, one of the Sun, and one of the Moon.

The first is of the Sun, *February* the 9th, invisible.

The second is of the Moon, *July* 22d, invisible.

Months	D	H.	Months	D	H.
January {			July {		
First quart.	7	11 M	First quart.	3	10 M
Full moon	14	1 A	Full moon	11	11 M
Last quart.	22	11 M	Last quart.	18	1 A
New moon	30	3 M	New moon	25	9 M
Febru. {			August {		
First quart.	5	8 A	First quart.	2	2 M
Full moon.	13	5 M	Full moon	9	10 A
Last quart.	21	8 M	Last quart.	16	5 A
New moon	28	2 A	New moon	23	8 A
March {			First quart.	31	9 A
First quart.	7	5 M	September {		
Full moon	14	10 A	Full moon	8	8 M
Last quart.	23	2 M	Last quart.	14	11 A
New moon	29	11 M	New moon	22	10 M
April {			First quart.	30	3 A
First quart.	5	3 A	October {		
Full moon	13	3 A	Full moon	7	5 A
Last quart.	21	3 M	Last quart.	14	8 M
New moon	28	8 M	New moon	22	3 M
May {			First quart.	30	7 M
First quart.	5	4 M	November {		
Full moon.	13	7 M	Full moon	6	2 M
Last quart.	21	1 M	Last quart.	12	8 A
New moon	27	4 A	New moon	20	10 A
June {			First quart.	28	9 A
First quart.	3	6 A	December {		
Full moon	11	10 A	Full moon	5	1 A
Last quart.	19	8 M	Last quart.	12	11 M
New moon	25	11 M	New moon	20	5 A
			First quart.	28	8 M

Five Eclipses this Year, three of the Sun, and two of the Moon.

The first is of the Moon, January the 14th, invisible.

The second is of the Sun, January the 29th, invisible.

The third is of the Moon, July the 10th, invisible.

The fourth is of the Sun, July the 24th, invisible.

The fifth is of the Sun, December the 20th, invisible.

Months	D	H.	Months	D	H
January {			July {		
Full moon	3	11 A	Last quart.	7	8 A
Last quart.	11	7 M	New moon	14	11 A
New moon	19	11 M	First quart.	22	1 M
First quart.	26	5 A	Full moon	30	5 M
Feb. {			August {		
Full moon	2	1 A	Last quart.	6	2 A
Last quart.	10	4 M	New moon	13	7 M
New moon	18	2 M	First quart.	20	5 A
First quart.	25	1 M	Full moon	28	6 A
March {			September {		
Full moon	4	2 M	Last quart.	4	8 A
Last quart.	12	1 M	New moon	11	6 A
New moon	19	3 A	First quart.	19	1 A
First quart.	26	8 M	Full moon	27	6 M
April {			October {		
Full moon	2	4 A	Last quart.	4	3 M
Last quart.	10	8 A	New moon	11	6 M
New moon	18	1 M	First quart.	19	7 M
First quart.	24	4 A	Full moon	26	6 A
May {			November {		
Full moon	2	8 M	Last quart.	2	10 M
Last quart.	10	11 M	New moon	9	9 A
New moon	17	9 M	First quart.	18	3 M
First quart.	24	1 M	Full moon	25	4 M
Full moon	31	11 A			
June {			December {		
Last quart.	8	11 A	Last quart.	1	8 A
New moon	15	4 A	New moon	9	4 A
First quart.	22	11 M	First quart.	17	8 A
Full moon.	30	3 A	Full moon	24	3 A
			Last quart.	31	9 M

Six Eclipses this Year, three of the Sun, and three of the Moon.

The first is of the Moon, Jan. 3d, visible, and Total 11 at Night

The second is of the Sun, January the 19th, at 11 M. 1 Digit

The third is of the Sun, June the 15th, at 5. A. 5 Digits.

The fourth is of the Moon, June the 30th, invisible.

The fifth is of the Sun, December the 9th, invisible.

The sixth is of the Moon, December the 24th, visible 9 Digits.

Months	D.	H.	Months	D.	H.
January {			July {		
New moon	8	11 M	New moon	3	4 A
First quart.	16	10 M	First quart.	10	8 M
Full moon	23	2 M	Full moon	18	8 M
Last quart.	30	1 M	Last quart.	26	6 M
Febr. {			August {		
New moon	7	7 M	New moon	1	11 A
First quart.	14	9 A	First quart.	8	7 A
Full moon	21	1 A	Full moon	16	10 A
Last quart.	28	9 A	Last quart.	24	4 A
March {			New moon	31	8 M
New moon	7	11 A	Sept. {		
First quart.	15	5 M	First quart.	7	9 M
Full moon	21	11 A	Full moon	15	1 A
Last quart.	29	4 A	Last quart.	22	11 A
April {			New moon	29	4 A
New moon	6	2 A	October {		
First quart.	13	11 M	First quart.	7	3 M
Full moon	20	11 M	Full moon	15	4 M
Last quart.	28	11 A	Last quart.	22	7 M
May {			New moon	29	3 M
New moon	6	1 M	November {		
First quart.	12	5 A	First quart.	6	1 M
Full moon	20	2 M	Full moon	13	5 A
Last quart.	28	5 M	Last quart.	20	2 A
June {			New moon	27	6 A
New moon	4	9 M	December {		
First quart.	11	1 M	First quart.	5	8 A
Full moon	18	3 A	Full moon	13	5 M
Last quart.	26	7 A	Last quart.	19	9 A
			New moon	27	1 M

Two Eclipses this Year, both of the Sun.

The first is *June 4th*, at 8 Morn. visible 4 Digits.

The second is *November 27th*, at 6 Afternoon, invisible.

A Table of the Moon's Age for the Year 1789. 29

Months	D.	H.	Months	D.	H.
January {	First quart.	4 4 A	July {	Full Moon	7 9M
	Full moon	11 6 A		Last quart.	15 11M
	Last quart.	18 9M		New moon	22 4 A
	New moon	26 6M		First quart.	29 6M
Febru. {	First quart.	3 9M	August {	Full moon	5 10 A
	Full moon	10 4M		Last quart.	14 2M
	Last quart.	16 10 A		New moon	20 11 A
	New moon	25 1M		First quart.	27 3 A
March {	First quart.	4 11 A	September {	Full moon	4 2 A
	Full moon	11 2 A		Last quart.	12 3 A
	Last quart.	18 2 A		New moon	19 7M
	New moon	26 7 A		First quart.	26 4M
April {	First quart.	3 9M	October {	Full moon	4 7M
	Full moon	9 11 A		Last quart.	12 2M
	Last quart.	17 8M		New moon	18 4 A
	New moon	25 10M		First quart.	25 8 A
May {	First quart.	2 3 A	November {	Full moon	2 11 A
	Full moon	9 9M		Last quart.	10 11M
	Last quart.	17 2M		New moon	17 3M
	New moon	24 10 A		First quart.	24 4 A
	First quart.	31 8 A	December {	Full moon	2 5 A
June {	Full moon	7 8 A		Last quart.	9 6 A
	Last quart.	15 7 A		New moon	16 5 A
	New moon	23 8M		First quart.	24 1 A
	First quart.	29 11 A			

Four Eclipses this Year, two of the Sun, and two of the Moon.

The first is of the Moon, *May* 8th, invisible.

The second is of the Sun, *May* the 24th, invisible.

The third is of the Moon, *Nov.* the 2d, visible, at Mid. 3 Dig.

The fourth is of the Sun, *November* the 16th, invisible.

Months	D.	H.	Months	D.	H.
January {	New moon	8 11 M	July {	New moon	3 4 A
	First quart.	16 10 M		First quart.	10 8 M
	Full moon	23 2 M		Full moon	18 8 M
	Last quart.	30 1 M		Last quart.	26 6 M
Febr. {	New moon	7 7 M	August {	New moon	1 11 A
	First quart.	14 9 A		First quart.	8 7 A
	Full moon	21 1 A		Full moon	16 10 A
	Last quart.	28 9 A		Last quart.	24 4 A
March {	New moon	7 11 A		New moon	31 8 M
	First quart.	15 5 M	Septem. {	First quart.	7 9 M
	Full moon	21 11 A		Full moon	15 1 A
	Last quart.	29 4 A		Last quart.	22 11 A
April {	New moon	6 2 A		New moon	29 4 A
	First quart.	13 11 M	October {	First quart.	7 3 M
	Full moon	20 11 M		Full moon	15 4 M
	Last quart.	28 11 A		Last quart.	22 7 M
May {	New moon	6 1 M		New moon	29 3 M
	First quart.	12 5 A	November {	First quart.	6 1 M
	Full moon	20 2 M		Full moon	13 5 A
	Last quart.	28 5 M		Last quart.	20 2 A
June {	New moon	4 9 M		New moon	27 6 A
	First quart.	11 1 M	December {	First quart.	5 8 A
	Full moon	18 3 A		Full moon	13 5 M
	Last quart.	26 7 A		Last quart.	19 9 A
				New moon	27 1 M

Two Eclipses this Year, both of the Sun.

The first is *June 4th*, at 8 Morn. visible 4 Digits.

The second is *November 27th*, at 6 Afternoon, invisible.

A Table of the Moon's Age for the Year 1789. 29

Months	D.	H.	Months	D.	H.
January {	First quart.	4 4 A	July {	Full Moon	7 9 M
	Full moon	11 6 A		Last quart.	15 11 M
	Last quart.	18 9 M		New moon	22 4 A
	New moon	26 6 M		First quart.	29 6 M
Febru. {	First quart.	3 9 M	August {	Full moon	5 10 A
	Full moon	10 4 M		Last quart.	14 2 M
	Last quart.	16 10 A		New moon	20 11 A
	New moon	25 1 M		First quart.	27 3 A
March {	First quart.	4 11 A	September {	Full moon	4 2 A
	Full moon	11 2 A		Last quart.	12 3 A
	Last quart.	18 2 A		New moon	19 7 M
	New moon	26 7 A		First quart.	26 4 M
April {	First quart.	3 9 M	October {	Full moon	4 7 M
	Full moon	9 11 A		Last quart.	12 2 M
	Last quart.	17 8 M		New moon	18 4 A
	New moon	25 10 M		First quart.	25 8 A
May {	First quart.	2 3 A	November {	Full moon	2 11 A
	Full moon	9 9 M		Last quart.	10 11 M
	Last quart.	17 2 M		New moon	17 3 M
	New moon	24 10 A		First quart.	24 4 A
	First quart.	31 8 A	December {	Full moon	2 5 A
June {	Full moon	7 8 A		Last quart.	9 6 A
	Last quart.	15 7 A		New moon	16 5 A
	New moon	23 8 M		First quart.	24 1 A
	First quart.	29 11 A			

Four Eclipses this Year, two of the Sun, and two of the Moon.

The first is of the Moon, *May* 8th, invisible.

The second is of the Sun, *May* the 24th, invisible.

The third is of the Moon, *Nov.* the 2d, visible, at Mid. 3 Dig.

The fourth is of the Sun, *November* the 16th, invisible.

A C A T A L O G U E

OF THE

MEAN NEW MOONS,

From the Year 1790 to 1799 inclusive.

1790.	1791.	1792.	1793.	1794.
January — 16	January — 5	January — 24	January — 12	January 1 & 31
February 14	February — 3	February 22	February 11	February —
March — 16	March — 5	March — 23	March — 12	March 1 & 31
April — 14	April — 4	April — 22	April — 11	April — 30
May — 14	May — 3	May — 21	May — 10	May — 29
June — 12	June 1 and 30	June — 20	June — 9	June — 28
July — 12	July 1 and 31	July — 19	July — 8	July — 27
August 10	August — 29	August — 18	August — 7	August — 26
September 9	September 28	September 16	September 5	September 24
October 8	October — 27	October — 16	October — 5	October — 24
November 7	November 26	November 14	November 3	November 22
December 6	December 25	December 14	December 3	December 22

1795.	1796.	1797.	1798.	1799.
January — 20	January 10	January — 28	January — 17	January — 6
February 19	February 8	February 26	February 16	February 5
March — 21	March — 9	March — 28	March — 17	March — 7
April — 19	April — 7	April — 27	April — 16	April — 5
May — 19	May — 7	May — 26	May — 15	May — 5
June — 17	June — 6	June — 24	June — 14	June — 3
July — 17	July — 5	July — 24	July — 13	July — 3
August — 15	August — 4	August — 22	August — 12	August 1 & 31
September 14	September 2	September 21	September 10	September 29
October — 13	October 1 & 31	October — 20	October — 10	October 29
November 12	November 30	November 19	November 8	November 27
December 11	December 29	December 18	December 8	December 27

V I S I B L E E C L I P S E S,

From the Year 1790 to 1799 inclusive.

1790 The Moon — April the 28th, at Midnight, Total.

— The Moon — October the 23d, at 1 in the Morning, Total.

1791 The Sun — April the 3d, at 1 in the Afternoon.

— The Moon — October the 12th, at 3 in the Morning.

1792 The Sun — September the 16th, at 11 in the Morning.

1793 The Moon — February the 25th, at 10 in the Afternoon.

— The Sun — September the 5th, at 3 in the Afternoon.

1794 The Sun — January the 31st, at 4 in the Afternoon.

— The Moon — February the 14th, at 11 in the Afternoon, Total.

— The Sun — August the 25th, at 5 in the Afternoon.

1795 The Moon — February the 4th, at 1 in the Morning.

— The Sun — July the 16th, at 9 in the Morning.

— The Moon — July the 31st, at 8 in the Afternoon.

1797 The Sun — June the 25th, at 8 in the Afternoon.

— The Moon — December the 4th, at 6 in the Morning.

1798 The Moon — May the 27th, at 7 in the Afternoon, Total.

1799 None.

The Use of the foregoing Tables of the Moon's Age.

IN the said Tables the one half Page contains the first six Months of the Year, the other half the following six Months; in the first Column of each half, towards the Left-hand are the Months; in the second the New, Full, and Quarters of the Moon; in the two following Columns are the Days and Hours of the said New, Full, and Quarters, either Morning or Afternoon, as the Letters A and M denote, A signifying Afternoon, M Morning: At the Bottom of each Table are the Eclipses for that respective Year.

The Use of the Tables is, readily by Inspection, to find the Day and Hour of the New, Full, or Quarters of the Moon.

Suppose it was desired to find the Time of New Moon, *January 1786*. Look for the Year 1786 on the Top of the Leaf, which having found, look for *January* in the first Column towards the Left-hand, then in the next Column, in the same Month, is found New Moon; and in the two following Columns against New Moon, stands 30d. 3h. M. which shews that the New Moon in *January 1786* is the 30th Day at 3 in the Morning.

The same Directions serve for Full Moon, or First and Last Quarters.

To find the Moon's Age, subtract the Day of New Moon from the Day proposed, the Remainder is the Moon's Age.

Suppose *December 25th, 1787*.

Looking in the Table in 1787, it gives the full Moon the 24th Day, so that on the 25th the Moon will be about 15 Days old.

Suppose it were required to find the Moon's Age the first of *November 1786*.

The last New Moon before was *October 22d*, but because you cannot take 22 from 1, you must add 31 the Days in *October*, and from the Sum take 22; the Remainder 10 is the Moon's Age *November 1st 1786*.

A TIDE-TABLE for the Sea-Coasts of Great-Britain, Ireland, Norway, Holland, Flanders, France, Biscay, &c. Shewing what Moon makes full Sea, upon the Full and Change Days, at the Places following, rang'd in Alphabetical Order.

A		H.M.	At Alhmarich & Antwerp,		H.M.
A	T Army NNE. and SSW.	1 30	East and West	— — —	6 0
	At Amsterdam & Armentiers, NE. and SW.	3 0	At Aldborough, SE. by S.	— — —	9 45
	At Abarquark, ENE. and WSW.	4 30	and NW. by N.	— — —	— — —

The Tide-Table.

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B	H.	M.	Between Guernsey, and the	H.	M.
At <i>Beachy</i> and <i>Blacktail</i> , and before the <i>Race of Blanquet</i> , on <i>Blanchart</i> , N and S. —	12	0	<i>Caskets</i> , before <i>Cromer</i> , <i>Seven Clifts</i> , and at <i>Catnefs</i> , SE. and NW. —	9	0
Thwart of <i>Beachy</i> in the <i>Of-fing</i> , N by E. and S by W. —	0	45	At the <i>Caskets</i> , and at <i>Chambernefs</i> , SE by S. & NW by N. —	9	45
At <i>Blacknefs</i> , in <i>Bluet</i> , at <i>Bell Ifle</i> , NNE. and SSW. —	1	30	At <i>Cows</i> , in the <i>Fofs of Caen</i> , in <i>Calais-Road</i> , and in <i>Chambernefs-Road</i> , SSE and NNW. —	10	30
Without <i>Bluet</i> , and at <i>Berwick</i> , NE by N. & SW by S. —	2	15	Before the Haven of <i>Caen</i> , in the <i>Chamber</i> , between <i>Cripple-fand</i> and the <i>Creyl</i> , and at <i>Cal-shot</i> , S by E. and N by W. —	11	15
The River of <i>Bordeaux</i> , the South Coast of <i>Bretagne</i> , the Coast of <i>Biscay</i> , and at <i>Buchanefs</i> , NE. and SW. —	3	0	D		
At <i>Brest</i> , before the <i>Base</i> , the River of <i>Bordeaux</i> within the Haven, NE by E. & SW by W. —	3	45	At <i>Dover-Pier</i> , and before <i>Dunkirk</i> , N and S. —	12	0
In the <i>Breefound</i> , <i>Bloy</i> , <i>Baltimore</i> , ENE. and WSW. —	4	30	At <i>Denbigh & Downs</i> in the Road, NE by N. & SW by S. —	2	15
Before <i>Bremen</i> , and at <i>Blackney</i> , and in the Channel before <i>Bordeaux</i> , E. and W. —	6	0	At <i>Dort</i> , NE and SW. —	3	0
At <i>Bristol Key</i> , E by S. and W by N. —	6	45	At <i>Dungervan</i> , ENE. and WSW. —	4	30
At <i>Bridgwater</i> , ESE. and WNW. —	7	30	At <i>Dartmouth</i> , E. and W. —	6	0
At <i>Boulogne-deep</i> , SSE & NNW	10	30	At <i>Dublin</i> , SE by E. and NW by W. —	8	15
C			At <i>Dunbar</i> , SE. and NW. —	9	0
In <i>Condado</i> , N. and S. —	12	0	At <i>Dungeness</i> and <i>Dunnofe</i> , SE by S. and NW by N. —	9	45
In the <i>Chamber of Rye</i> , N by E. and S by W. —	0	45	At <i>Dover</i> , <i>Dieppe</i> , and in the <i>Downs</i> a-shore SSE. and NW. —	10	30
Without <i>Calais</i> , at <i>Corpus Christi</i> Point, before and at <i>Campvere</i> , NNE. and SSW. —	1	30	E		
Between <i>Calais</i> and <i>Dover</i> , before <i>Conquet</i> , and at the North Cape, NE. and SW. —	3	0	At <i>Emden</i> , before the <i>Elb</i> , before the <i>Eyder</i> , and before <i>Enchufan</i> , N. and S. —	12	0
At <i>Cork</i> , <i>Calais</i> , <i>C. Clear</i> and in the <i>Creek</i> , ENE. and WSW. —	4	30	At <i>Edam</i> , NNE. and SSW. —	1	30
At <i>Caldy</i> , and in the Bay of <i>Carmarthen</i> , E by N & W by S. —	5	15	Before the Eastern & Western <i>Emes</i> , and at <i>Engoments</i> , SE. and NW. —	9	0
At <i>Concate</i> , E. and W. —	6	0	F		
Without the <i>Caskets</i> , in the Channel, SE by S. & NW by W. —	8	15	On the Coast of <i>Flanders</i> , N. and S. —	12	0
			At <i>Flushing</i> , N by E. and S by W. —	0	45
			E Before		

Before the *Fen*, in the Channel, NNE. and SSW. —

Without *Fountny*, NE by N. and SW by S. —

Without the Banks of *Flanders*, NE. and SW. —

At *Flamborough* and *Bridlington*, ENE and WSW. —

At the *Forn* in *Fowey*, at *Falmouth*, E by N. and W by S. —

Between *Fowey* & *Falmouth*, in the Channel, and at *Foulness*, E by S. and W by N. —

Before the Coast of *Frizeland* and the *Fly*, ESE. and WNW. —

Without the *Fly*, SE by E. and NW by W. —

At *Frize* and *Fair-Isle*, NW. and SE. —

At the *Frith*, and at the *South Foreland*, SSE. and NNW. —

In *Fair Isle Roads*, and at the *North Foreland*, S by E. and N by W. —

G

In the Road of *Gibraltar*, at *Graveling*, and before *Cherburg*, N and S. —

Before *Goree*, at *Guernsey*, and at *Gravesend*, NNE. and SSW. —

At *Groin*, at *Gascoign*, and the Coast of *Gallicia*, NE. and SW. —

Between *Guernsey* & *Caskets*, SE. and NW. —

Thwart of *Guernsey* in the Channel, SE by S. and NW by N. —

In the *Chamber* and *Goree-end*, S by E. and N by W. —

H

Before the *Heuer*, before

H. M. *Horn*, and at *Hampton-Key*, N and S. —

Under *Holy Island*, and at *Horn*, NNE. and SSW. —

Before *Hartlepool*, NE. and SW. —

At *Huntcliff-foot*, NE by E. and SW by W. —

At *Humber*, E by N. & W by S. —

Before *Hamborough*, at *Hull*, at the *Holms*, and before *Humber's Mouth*, E and W. —

At *Harlem*, *Havre de Grace*, and *Homehead*, SE and NW. —

At *St. Helens*, at *Harwich*, and without the Banks of *Harwich*, SSE. and NNW. —

At *Harwich* within, S by E. and N by W. —

I

At *Jutland Islands*, N. and S. —

On the West Coast of *Ireland*, NE. and SW. —

In all the Havens of the South Coast of *Ireland*, E by N. and W by S. —

K

Kentish Knock, N. and S. —

At *Kelliers*, NE. and SW. —

At *Kingsale*, ENE & WSW. —

At *Kilduyn*, ESE & WNW. —

At *Keldive*, SE and NW. —

L

At *Leith*, North and South —

At *Lisbon*, NE by N. and SW by S. —

At *London*, NE and SW. —

Thwart of *Lundey*, and before *Lynn*, E by N. and W by S. —

At *Lynn Half-Tide*, at *Lundey*, East and West —

At *Lynn*, E by S. and W by N. —

At

35

M		H.	M		H.	M
0	At the <i>Lizard</i> by the Land, ESE. and WNW. ————	7	30	Between the <i>Naze</i> and <i>War-</i> <i>head of Lower</i> , S by E & N by W. ————	11	15
30	At <i>Lambay</i> , SE. by E. and NW by W. ————	8	15	O At <i>Orknefs</i> , NE and SW. ————	3	0
0	At <i>Leostaff</i> , and thwart of it without the Banks, SE by S. and NW by N. ————	9	45	At <i>Orkney</i> , SE and NW. ————	9	0
45	In <i>Leostaff-Road</i> and at <i>Long-</i> <i>land-head</i> , SSE. and NNW. ————	10	30	At <i>Orfordnefs</i> , SE by S. and NW by N. ————	9	45
15	M. Within the <i>Maes</i> , at <i>Maldon</i> , N by E. and S by W. ————	0	45	At <i>Orfordnefs</i> , without the Banks, and between <i>Orford</i> and <i>Orwell Waves</i> , SSE. & NNW. ————	10	30
0	Before the <i>Maes</i> , NNE. and SSW. ————	1	30	At <i>Orfordnefs</i> , within the Sands, S by E. and N by W. ————	11	15
0	At the <i>Maes</i> , and before St. <i>Matthew's Point</i> , NE by E. and SW by W. ————	3	45	At <i>Ostend</i> , N and S. ————	12	0
30	In <i>Moufehole</i> , at St. <i>Mat-</i> <i>thew's</i> , and within <i>Mount's-bay</i> , ENE. and WSW. ————	4	30	P At <i>Portsmouth</i> Half-Tide, N by W. and S by E. ————	11	15
15	In <i>Milford</i> , at <i>Moonlefs</i> , at St. <i>Maloes</i> , E by N. and W by S. ————	5	15	At the <i>Pens</i> , <i>Porthus</i> , and <i>Poictu</i> , NE and SW. ————	3	0
0	Between <i>Moufehole</i> and <i>Fal-</i> <i>mouth</i> , and in <i>Milford-Haven</i> , ESE. and WNW. ————	7	30	On the Coast of <i>Portugal</i> , NE by E. and SW by W. ————	3	45
15	In St. <i>Magnes</i> Sound, and at <i>Magnes Castle</i> , SE. by E. and NW by W. ————	8	15	In <i>Plymouth</i> , and before St. <i>Paul's</i> , E by N. and W by S. ————	5	15
0	At the <i>Isle of Man</i> , SE & NW ————	9	0	At St. <i>Paul's</i> , in the Haven, E and W. ————	6	0
30	Before <i>Margate</i> , S by E. and N by W. ————	11	15	Before <i>Podessemeck</i> , E by S. and W by N. ————	6	45
0	N. At <i>Newport</i> Half-tide, N & S ————	12	0	Thwart of <i>Plymouth</i> , ESE. and WNW. ————	7	30
0	At the West-end of the <i>Nore</i> , N by E. and S by W. ————	0	45	At the Race of <i>Portland</i> , SE. and NW. ————	9	0
15	Before the River of <i>Nantz</i> , NE. and SW. ————	3	0	Q At <i>Queenborough</i> , N. and S. ————	12	0
0	At <i>Newcastle</i> , E by N & W by S. ————	5	15	R At <i>Rocheſter</i> , N by E & S by W ————	0	45
15	Before St. <i>Nicholas</i> , E by S. and W by N. ————	6	45	At <i>Ramkins</i> , NNE. & SSW. ————	1	30
0	At the <i>Needles</i> , at the <i>Isle of</i> <i>Wight</i> , SE by E. & NW by W. ————	8	15	At <i>Rotterdam</i> in <i>Robin-Hood's</i> <i>Bay</i> , and from the Race to the <i>Pole-head</i> , NE. and SW. ————	3	0
45	All the Coast of <i>Normandy</i> , and <i>Pica-ry</i> , SSE. and NNW. ————	10	30	At <i>Rouen</i> , and before <i>Rochel</i> , NE by E. and SW by W. ————	3	45
				In <i>Ramsfey</i> , E by N & W by S. ————	5	15
				S In the <i>Sleeve</i> , between <i>Uphant</i> and <i>Scilly</i> , at the <i>Shoe</i> , at the		
				E 2 Spits		

Spits, at Southampton, and along the Swin, North and South —	12	0	In the <i>Vour</i> , at the Bay, within <i>Ushant</i> , ENE & WSW.	4	30
Upon the Coast of Spain, and in Shetland, NE. and SW. —	3	0	Without <i>Ushant</i> , E and W. St. Vallery, SSE. & NNW.	10	30
At Scilly, the Sound, Scarborough & at Staples, NE by E & SW by W	3	45	W At <i>Winchelsea</i> , N by E. and S by W.	0	45
At Seven Isles, without the Haven, in the Broad Sound, ENE. and WSW. —	4	30	At the <i>Weilings</i> , and from the West-end of the <i>Wight</i> , NNE. and SSW.	1	30
At the Mouth of Severn between Scilly & the Lizard, at the Spurn and Stockton, E by N. & W by S.	5	15	Before the <i>Weilings</i> , NE by N. and SW by S.	2	15
Without Scilly, in the Channel, and at Salcomb, E. and W.	6	0	At <i>Whitby</i> , NE. and SW.	3	0
At Sedmouth, and at the Start, E by S. and W by N. —	6	45	In the Sea of <i>Wales</i> , and <i>Severn</i> , ENE. and WSW. —	4	30
Off the Start in the Channel, ESE. and WNW. —	7	30	In <i>Wales</i> , E by N & W by S	5	15
Within the <i>Seine</i> , and before <i>Shelbergh</i> , at 7 Clifts, SE & NW.	9	0	At <i>Wells</i> , at <i>Weymouth</i> , and at <i>Waterford</i> , E. and W. —	6	0
At <i>Shoram</i> , SE by S & NW by N	9	45	At <i>Weymouth Key</i> , E by S. and W by N. —	6	45
At <i>Seine-head</i> , SSE. & NNW.	10	30	At the <i>Nefs</i> , by <i>Wieringhen</i> , at <i>Winterton</i> , ESE. and WNW.	7	30
T			Thwart of the Isle of <i>Wight</i> , in the Channel, all within the Isle of <i>Wight</i> , between the Isle of <i>Wight</i> , and <i>Beachy</i> , by the shore, SE by E. & NW by W.	8	15
Within <i>Tervere</i> , N by E. & S by W. —	0	45	At the E. end of the <i>Wight</i> , and on <i>Wieringhen Flats</i> , SE and NW. —	9	0
Before <i>Tervere</i> , before the River of <i>Thames</i> , and at <i>Tinmouth</i> , NNE. and SSW. —	1	30	Y		
Before the <i>Tees</i> and <i>Tinmouth</i> , before the Bay of <i>Tinmouth</i> , NE. and SW. —	3	0	Before <i>Yarmouth</i> , NNE. & SSW. —	1	0
At the Cliffs off the <i>Texel</i> , ENE. and WSW. —	4	30	At <i>Youghall</i> , ENE. and W. SW.	4	30
In <i>Torbay</i> , and before the <i>Texel</i> , E. and W. —	6	0	At <i>Yarmouth</i> , SE by E. and NW by W.	8	15
In the Road of the <i>Texel</i> , ESE. and WNW. —	7	30	In <i>Yarmouth Road</i> , in <i>Yarmouth Haven</i> , SSE. & NNW.	10	30
At <i>Torgen</i> , S E. by S. and NW by N. —	9	45	Z		
U			On the Coast of <i>Zealand</i> , NNE. and SSW. —	1	30
Before <i>Ureck</i> , N. and S.	12	0	In the <i>Zurich-sea</i> , NE & SW.	3	15
At <i>Ufe</i> , NE. and S.W. —	3	0	T H E		
Between <i>Ushant</i> , and the Main, NE by E. & SW by W.	3	45			

THE foregoing Table shews the Time of Full Sea at the several Places therein contained, upon the Full and Change Days of the Moon, which for more ready Use is put in Alphabetic Order.

Example. Admit the Time of Full Sea at *London*, upon the Full and Change Days, be required.

Look into the Table under the Letter (L) it is found to flow at *London*, North East and South West; that is, when it is Full Sea at *London*, the Moon will be, as it is vulgarly said, upon the North East and South West Points of the Compass, which is four Points, or 3 Hours.

The Use of this, together with the Moon's Southing, to find the Time of Full Sea at any Time, at any of the said Places is shewn below.

To find the Moon's Southing.

To find the Southing of the Moon, multiply the Moon's Age by 4, and divide the Product by 5, the Quotient will be Hours, and the Remainder so many Times 12 Minutes.

Note. If the Moon's Age exceeds 15, reject the said 15, and take the Remainder, with which proceed instead of the Moon's Age, and it gives her Southing in the Morning.

Example. Suppose the Time of the Moon's Southing be required on the 19th of *November*, 1784. The Moon's Age is found to be 6 Days, which multiplied by 4 and divided by 5, gives 4 Hours, and the Remainder 4, multiplied by 12, gives 48 Min. or the Moon souths at 48 Min. after 4 o'Clock in the Afternoon.

I shall here add a Table of the Moon's Southing to every Day of her Age.

Moon's Age	Time.	
	H.	M.
1 or 16	0	48
2	1	36
3	2	24
4	3	12
5	4	00
6	4	48
7	5	36
8	6	24
9	7	12
10	8	00
11	8	48
12	9	36
13	10	24
14	11	12
15	12	00

The Use of the TABLE.

The first Column shews the Moon's Age, the second the Southing.

Example.

The Moon being 9 Days old and her Southing, required.

In the first Column under the Title Moon's Age stands 9; over against it in the last Column is 7 Hours 12 Minutes, the Time of the Southing required.

Note also, The same Southing serves for 24 Days old which serves for 9 Days, as the Table shews; only observe that if the Moon be under 15 Days old, her Southing is in the Afternoon, but

if above that Age, then in the Morning.

Thus.

Thus having got the Moon's Southing, proceed to find the Time of Full Sea, as follows.

Suppose the Moon to be 9 Days old, the Time of Full Sea in the Downs a-shore, is required.

By the foregoing Table it appears that a N N W. and S S E. Moon makes full Sea, which as the said Table shews, is 10 Hours 30 Minutes; to which is added the Moon's Southing at 9 Days old, (*viz.* 7 Hours 12 Minutes) it makes 17 Hours 42 Minutes, or 5 Hours 42 Minutes (rejecting 12 Hours) in the Morning.

But to be more exact, use the following Table and Directions.

Moon's Age.	Time	
	H.	M
1	16	0
2	17	1
3	18	1
4	19	2
5	20	2
6	21	3
7	22	4
8	23	4
9	24	5
10	25	6
11	26	7
12	27	9
13	28	10
14	29	11
15	30	00

Having found the Time of Full Sea, upon the Full and Change Days, by the preceding Table for that Purpose, enter this Table with the Moon's Age: Against which in the last Column are the Hours and Minutes to be added for the Time of Full Sea desired.

Example.

Suppose as before, the Moon being 9 Days old, and the Time of Full Sea in the Downs a-shore is required.

A N N W. and S S E. Moon makes full Sea upon the Full and Change Days, which is 10 Hours 30 Minutes, this found enter the opposite Table with the Moon's Age 9 Days, against which stands 5 hours 50 min. which added to 10 hours 30 min. makes 16 hours 20 min. or 4 hours 20 min. (rejecting 12 hours) in the Morning.

Here follows

A New and Exact CALENDAR

O F

The Golden Number, Epact and Moveable Feasts, until the Year 1809; as also of the Sun's Place and Declination to every Day of the Year, for the First, Second, Third, and Leap-Year, calculated for, and from the Year 1784, and made to serve (without any considerable Error) till the Year 1799. Likewise the Sun's Rising, whereby may be found the Time of the Setting, and Length of the Day and Night; together with the Southing of the Principal Fixed Stars at Midnight.

A

A T A B L E of the Dominical-Letters, Cycle of the Sun, Prime, Epact, and Moveable Feasts, for 26 Years to come.

Years.	Dom. Lette.	Cycle of ☉	Prime	Epact	Shrove-Sunday	Easter-Sunday	Whit-Sunday
1784	DC	1	18	7	February 22	April 11	May 30
1785	B	2	19	18		6 March 27	15
1786	A	3	1	0	26	April 16	June 4
1787	G	4	2	11	18	8 May	27
1788	FE	5	3	22	3 March	23	11
1789	D	6	4	3	February 22	April 12	May 31
1790	C	7	5	14	14	4	23
1791	B	8	6	25	March 6	24 June	12
1792	AG	9	7	6	February 19	8 May	27
1793	F	10	8	17	10 March	31	19
1794	E	11	9	28	March 2	April 20	June 8
1795	D	12	10	9	February 15	April 5	May 24
1796	CB	13	11	20	7 March	27	15
1797	A	14	12	1	26 April	16 June	4
1798	G	15	13	12	18	8 May	27
1799	F	16	14	23	February 3	March 24	May 12
1800	E	17	15	4	23 April	13 June	1
1801	D	18	16	15	15	5 May	24
1802	C	19	17	26	March 1	18 June	6
1803	B	20	18	7	February 20	10 May	29
1804	AG	21	19	18	11	1	20
1805	F	22	1	0	February 24	April 14	June 2
1806	E	23	2	11	16	6 May	25
1807	D	24	3	22	1 March	22	10
1808	CB	25	4	3	20 April	10	29
1809	A	26	5	14	12	2	21

Month	Week Days	Remarkable days, and fou- thing of Stars at Midnight	Leap	Year	Year	Year	Year	Year	Year
			1784	1788	1785	1789	1786	1790	1787
			1792	1796	1793	1797	1794	1798	1795
Days			☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla
			D M	D M	D M	D M	D M	D M	D M
			Yp	South	Yp	South	Yp	South	Yp
1	R	Circumcision	10 45	23 11	11 32	22 57	11 17	22 59	11 3
2	B	Sun r. 8. 5.	11 46	22 56	12 33	22 52	12 1	22 53	12 4
3	S		12 48	22 50	13 34	22 46	13 20	22 48	13 5
4	D		13 49	22 44	14 36	22 39	14 21	22 41	14 6
5	E		14 50	22 38	15 37	22 34	15 22	22 34	15 8
6	F	Epiphany	15 52	22 31	16 38	22 25	15 23	22 27	16 9
7	G		16 53	22 23	17 39	22 18	17 24	22 20	17 10
8	A	Castor & Polux	17 54	22 16	18 40	22 9	18 26	22 11	18 12
9	B	Procyon.	18 55	22 7	19 41	22 1	19 28	22 3	19 13
10	C		19 56	21 58	20 42	21 52	20 28	21 54	20 14
11	D	Sun r. 7. 56.	20 57	21 49	21 43	21 42	21 30	21 45	21 15
12	E		21 58	21 40	22 46	21 32	22 31	21 35	22 15
13	F		22 59	21 30	23 47	21 22	23 32	21 25	23 18
14	G		24 1	21 19	24 48	21 11	24 32	21 14	24 19
15	A		25 2	21 0	25 48	21 1	25 33	21 3	25 10
16	B		26 3	20 58	26 49	20 48	26 35	20 51	26 21
17	C		27 4	20 46	27 50	20 37	27 37	20 40	27 22
18	D		28 5	20 34	28 51	20 24	28 38	20 27	28 23
19	E		29 6	20 21	29 53	20 12	29 39	20 15	29 24
20	F	Sol. in Aqua.	30 7	20 8	30 54	19 53	30 40	20 2	30 25
21	G		1 8	19 55	1 56	19 45	1 39	19 48	1 26
22	A	Sun r. 7. 44.	2 10	19 42	2 57	19 31	2 41	19 35	2 27
23	B		3 10	19 28	3 58	19 17	3 42	19 21	3 28
24	C		4 11	19 13	4 59	19 1	4 43	19 6	4 29
25	D	Conv. St. Paul	5 12	18 59	6 0	18 47	5 44	18 51	5 30
26	E		6 13	18 44	7 0	18 32	6 45	18 36	6 31
27	F		7 14	18 29	8 1	18 17	7 46	18 21	7 32
28	G		8 16	18 13	9 1	18 1	8 47	18 5	8 33
29	A		9 17	17 56	10 2	17 45	9 48	17 49	9 34
30	B	K. Chales M.	10 18	17 41	11 3	17 28	10 49	17 32	10 35
31	C		11 19	17 24	12 4	17 11	11 50	17 15	11 36

February hath XXVIII Days.

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Month	Week Days	Remarkable days, and four-thing of Stars at Midnight	Leap	Year	First	Year	Second	Year	Third	Year								
			1784	1788	1785	1789	1786	1790	1787	1791								
			1792	1796	1793	1797	1794	1798	1795	1799								
			☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec								
			D M	D M	D M	D M	D M	D M	D M	D M								
			☞	South	☞	South	☞	South	☞	South								
1	S	Sun r. 7. 28 Purif. Mary	12	20	17	7	13	6	16	54	13	50	16	58	12	36	17	2
2	S		13	21	16	49	14	7	16	36	13	52	16	41	13	36	16	45
3	S		14	21	16	33	15	7	16	18	14	52	16	23	14	37	16	28
4	S		15	22	16	15	16	8	16	0	15	53	16	4	15	38	16	10
5	S		16	23	15	57	17	8	15	43	16	53	15	47	16	39	15	52
6	S		17	24	15	38	18	9	15	24	17	54	15	28	17	39	15	33
7	S		18	23	15	20	19	10	15	5	18	55	15	10	18	40	15	14
8	S		19	25	15	1	20	10	14	46	19	56	14	50	19	41	14	56
9	S		20	26	14	42	21	11	14	27	20	56	14	32	20	42	14	36
10	S		21	25	14	22	22	11	14	7	21	55	14	12	21	42	14	17
11	S		22	27	14	3	23	12	13	48	22	57	13	52	22	43	13	57
12	S		23	27	13	42	24	13	13	28	23	58	13	33	23	43	13	37
13	S	Valentine Lyon's Heart Lyon's Neck	24	27	13	23	25	13	13	7	24	59	13	12	24	44	13	17
14	S		25	28	13	2	26	14	12	47	26	0	12	51	25	44	12	57
15	S		26	28	12	42	27	14	12	26	27	0	12	31	26	45	12	36
16	S		27	29	12	21	28	15	12	4	28	0	12	11	27	46	12	16
17	S	Sun r. 7. 46.	28	29	12	1	29	15	11	44	29	2	11	49	28	46	11	55
18	S	Sol. in Pisces	29	30	11	38	30	16	11	23	30	1	11	28	29	46	11	34
19	S		30	31	11	18	1	16	11	2	1	11	8	30	47	11	12	
20	S		1	31	10	57	2	16	10	40	2	2	10	46	1	47	10	51
21	S	Sun r. 6. 49 St. Matthias	2	31	10	35	3	17	10	18	3	2	10	24	2	48	10	28
22	S		3	31	10	13	4	17	9	56	4	3	10	2	3	48	10	7
23	S		4	32	9	51	5	18	9	34	5	4	9	40	4	48	9	45
24	S		5	32	9	28	6	18	9	12	6	3	9	18	5	49	9	23
25	S	Lower of the two Foremost in ☐ of great Bear.	6	32	9	7	7	18	8	49	7	4	8	54	6	49	9	59
26	S		7	32	8	44	8	18	8	28	8	4	8	33	7	49	8	38
27	S		8	33	8	22	9	18	8	4	9	4	8	11	8	49	8	16
28	S		9	34	8	0	10	18	7	41	10	4	7	48	9	49	7	53
29	S		10	34	7	37												
			When	it is,	Leap	Year	Feb.	hath 29	Days									

Month	Week Days	Remarkable days, and fou- thing of Stars at Midnight	Leap 1784 1792		Year 1788 1796		First 1785 1793		Year 1789 1797		Second 1786 1794		Year 1790 1798		Third 1787 1795		Year 1791 1799	
			☉ pla		☉ dec		☉ pla		☉ dec		☉ pla		☉ dec		☉ pla		☉ dec	
			D M		D M		D M		D M		D M		D M		D M		D M	
			✕		South		✕		South		✕		South		✕		South	
1	D	David	11	34	7	13	11	18	7	20	11	4	7	25	10	49	7	31
2	E		12	33	6	50	12	18	6	57	12	4	7	2	11	50	7	8
3	F		13	33	6	27	13	19	6	34	13	4	6	38	12	50	6	45
4	G	Sun r. 6. 29	14	33	6	4	14	19	6	11	14	4	6	16	13	50	6	22
5	A		15	33	5	41	15	19	5	47	15	4	5	53	14	50	5	58
6	B		16	33	5	18	16	19	5	24	16	4	5	30	15	50	5	35
7	C		17	33	4	54	17	19	5	1	17	4	5	6	16	50	5	12
8	D		18	33	4	31	18	19	4	37	18	4	4	43	17	49	4	48
9	E		19	33	4	8	19	18	4	14	19	4	4	20	18	49	4	25
10	F		20	32	3	45	20	18	3	50	20	4	3	56	19	49	4	2
11	G	Sun r. 6. 14	21	32	3	21	21	18	3	27	21	3	3	33	20	49	3	38
12	A		22	32	2	57	22	18	3	3	22	3	3	8	21	49	3	15
13	B	Lyon's Tail	23	32	2	34	23	17	2	28	23	3	2	45	22	48	2	51
14	C	Lower of two	24	31	2	10	24	17	2	16	24	2	2	22	23	48	2	27
15	D	latter in ☐ of	25	31	1	46	25	17	1	52	25	2	1	58	24	48	2	4
16	E	great Bear.	26	31	1	23	26	16	1	29	26	2	1	34	25	47	1	40
17	F		27	30	0	58	27	16	1	5	27	1	1	11	26	47	1	16
18	G		28	30	0	36	28	16	0	41	28	1	0	47	27	47	0	53
19	A		29	29	0	12	29	15	0	18	29	1	0	23	28	46	0	28
20	B	Sol. in Aries.	Y	29	N.	12	Y	14	N	6	Y	0	0	0	29	46	0	4
21	C	Upper of two	1	28	0	36	1	14	0	30	1	0	N	23	Y	45	N	17
22	D	latter in ☐ of	2	27	0	58	2	13	0	52	1	59	0	47	1	45	0	41
23	E	great Bear.	3	27	1	22	3	13	1	16	2	59	1	10	2	44	1	5
24	F		4	26	1	45	4	12	1	40	3	58	1	34	3	43	1	27
25	G	Lady Day.	5	26	2	10	5	11	2	3	4	57	1	57	4	43	1	52
26	A		6	25	2	32	6	11	2	27	5	56	2	21	5	42	2	15
27	B		7	24	2	56	7	10	2	50	6	56	2	45	6	41	2	40
28	C		8	23	3	20	8	10	3	14	7	55	3	8	7	40	3	2
29	D	Sun r. 5. 31.	9	22	3	44	9	8	3	37	8	54	3	31	8	40	3	26
30	E		10	21	4	6	10	8	4	1	9	53	3	55	9	39	3	50
31	F		11	20	4	30	11	7	4	23	10	52	4	18	10	38	4	12

Month Days	Week Days	Remarkable days, and fouthing of Stars at Midnight.	Leap	Year	First	Year	Second	Year	Third	Year
			1784 1792	1788 1796	1785 1793	1789 1797	1786 1794	1790 1798	1787 1795	1791 1799
			☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec
			D M	D M	D M	D M	D M	D M	D M	D M
			Υ	North	Υ	North	Υ	North	Υ	North
1	♈	Left but two	12 21	4 52	12 5	4 47	11 51	4 41	11 37	4 35
2	♈	in Great Bears	13 20	5 15	13 4	5 10	12 50	5 4	12 36	4 58
3	♈	Tail.	14 18	5 38	14 3	5 32	13 49	5 27	13 35	5 21
4	♈	Sun r. 5. 13 1.	15 17	6 1	15 2	5 55	14 48	5 50	14 34	5 45
5	♈		16 15	6 24	16 1	6 18	15 47	6 13	15 33	6 7
6	♈		17 15	6 46	17 0	6 41	16 46	6 35	16 32	6 30
7	♈		18 14	7 8	17 59	7 3	17 45	6 58	17 31	6 52
8	♈	Virgins Spike	19 12	7 31	18 58	7 26	18 44	7 20	18 30	7 15
9	♈	Left but one	20 11	7 53	19 57	7 48	19 43	7 43	19 28	7 37
10	♈	in Great Bears	21 10	8 16	20 56	8 10	20 41	8 5	20 27	7 59
11	♈	Tail.	22 8	8 37	21 54	8 32	21 40	8 27	21 26	8 21
12	♈	Sun r. 5. 12.	23 7	8 59	22 53	8 54	22 39	8 48	22 25	8 43
13	♈		24 6	9 21	23 52	9 16	23 37	9 10	23 23	9 5
14	♈		25 4	9 42	24 50	9 37	24 36	9 32	24 22	9 27
15	♈	Left in Great	26 3	10 4	25 49	9 58	25 34	9 53	25 21	9 48
16	♈	Bear's Tail.	27 2	10 25	26 47	10 20	26 33	10 15	26 19	10 10
17	♈	Sun r. 5. 6.	2 1	10 46	27 46	10 41	27 32	10 36	27 18	10 31
18	♈		2 0	11 7	28 44	11 2	28 31	10 57	28 16	10 52
19	♈		29 58	11 28	29 43	11 23	29 29	11 18	29 15	11 13
20	♈	Sol. in Taurus	3 1	11 48	30 41	11 43	30 27	11 38	30 14	11 33
21	♈	Sun r. 4. 55.	1 54	12 8	1 40	12 3	1 26	11 58	1 12	11 54
22	♈	Dragon's Tail	2 52	12 28	2 38	12 24	2 24	12 19	2 10	12 14
23	♈	St. George.	3 50	12 48	3 36	12 44	3 23	12 40	3 8	12 34
24	♈	Arcturus.	4 49	13 8	4 35	13 3	4 21	12 58	4 7	12 54
25	♈	St Mark Evan	5 47	13 27	5 33	13 23	5 19	13 18	5 5	13 13
26	♈		6 45	13 47	6 31	13 42	6 17	13 37	6 3	13 33
27	♈		7 44	14 6	7 30	14 1	7 16	13 57	7 2	13 52
28	♈	Day inc. 6. 55.	8 42	14 25	8 28	14 20	8 14	14 15	8 0	14 11
29	♈		9 40	14 43	9 26	14 38	9 12	14 34	8 59	14 30
30	♈		10 38	15 1	10 24	15 56	10 10	15 53	9 56	15 48

Month Days	Week Days	Remarkable days, and fouthing of Stars at Midnight.	Leap		Year		First		Year		Second		Year		Third		Year	
			1784	1788	1785	1789	1786	1790	1787	1791	1792	1796	1793	1797	1794	1798	1795	1799
			☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec
			D	M	D	M	D	M	D	M	D	M	D	M	D	M	D	M
			♈		North		♈		North		♈		North		♈		North	
1	♈	Phil. & Jacob	11	36	15	20	11	22	15	15	11	8	15	11	10	54	15	6
2	♈		12	35	15	38	12	20	15	31	12	6	15	30	11	52	15	24
3	♈	Sun r. 4. 38.	13	32	15	55	13	18	15	51	13	4	15	46	12	51	15	42
4	♈		14	30	16	12	14	16	16	8	14	2	16	4	13	49	16	1
5	♈	Upper of two	15	28	16	30	15	14	16	25	15	1	16	21	14	47	16	17
6	♈	foremost in ☐	16	26	16	46	16	12	16	42	15	59	16	38	15	45	16	34
7	♈	of little Bear	17	24	17	3	17	10	16	59	16	57	16	54	16	42	16	50
8	♈	N. Scale of ♏	18	22	17	20	18	8	17	14	17	54	17	11	17	40	17	7
9	♈		19	20	17	34	19	6	17	31	18	52	17	27	18	38	17	23
10	♈		20	18	17	50	20	4	17	46	19	50	17	43	19	36	17	39
11	♈		21	16	18	6	21	2	18	2	20	48	17	58	20	34	17	54
12	♈		22	14	18	21	22	3	18	17	21	46	18	13	21	32	18	9
13	♈	Sun r. 4. 17.	23	11	18	36	22	5	18	32	22	44	18	28	22	30	18	24
14	♈	Brightest in	24	9	18	50	23	5	18	45	23	42	18	43	23	28	18	38
15	♈	the Crown	25	7	19	4	24	5	19	1	24	39	18	57	24	25	18	53
16	♈	Brightest in	26	5	19	17	25	5	19	14	25	37	19	11	25	23	19	7
17	♈	Serpent's neck	27	3	19	31	26	4	19	27	26	35	19	25	26	21	19	21
18	♈		28	1	19	44	27	4	19	41	27	32	19	37	27	19	19	35
19	♈		28	59	19	57	28	4	19	53	28	30	19	50	28	16	19	47
20	♈	Scorpion's Forehead.	29	56	20	9	29	4	20	6	29	28	20	2	29	13	20	2
21	♈	Sol in Gemini	II	53	20	22	II	40	20	18	II	25	20	15	II	12	20	12
22	♈	Sun r. 4. 5.	1	51	20	33	1	37	20	30	1	24	20	27	1	9	20	24
23	♈		2	48	20	45	2	34	20	41	2	22	20	39	2	7	20	36
24	♈		3	46	20	55	3	32	20	53	3	18	20	51	3	4	20	47
25	♈	Scorpion's Heart.	4	43	21	6	4	30	21	3	4	16	21	0	4	2	20	58
26	♈		5	41	21	16	5	27	21	14	5	14	21	11	5	1	21	8
27	♈		6	39	21	26	6	25	21	24	6	11	21	21	5	57	21	20
28	♈		7	36	21	36	7	22	21	33	7	8	21	31	6	54	21	30
29	♈	K.C. II.B&R	8	33	21	45	8	21	21	43	8	6	21	40	7	52	21	39
30	♈	Sun r. 3. 55.	9	31	21	54	9	17	21	52	9	3	21	49	8	50	21	47
31	♈		10	28	22	2	10	14	22	1	10	1	21	58	9	47	21	56

June hath XXX Days.

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Month	Week Days	Remarkable days, and fouthing of Stars at Midnight.	Leap		Year		First		Year		Second		Year		Third		Year	
			1784	1792	1788	1796	1785	1793	1789	1797	1786	1794	1790	1798	1787	1795	1791	1799
			⊙ pla	⊙ dec	⊙ pla	⊙ dec	⊙ pla	⊙ dec	⊙ pla	⊙ dec	⊙ pla	⊙ dec	⊙ pla	⊙ dec	⊙ pla	⊙ dec	⊙ pla	⊙ dec
			D	M	D	M	D	M	D	M	D	M	D	M	D	M	D	M
			II	North	II	North	II	North	II	North	II	North	II	North	II	North	II	North
1	☾	Sun. r. 3. 52.	11	26	22	10	11	12	22	8	10	58	22	6	10	45	22	4
2	☿		12	23	22	18	12	9	22	16	11	56	22	14	11	42	22	12
3	☽		13	22	22	25	13	7	22	23	12	53	22	22	12	39	22	20
4	☿		14	18	22	32	14	4	22	30	13	51	22	30	13	37	22	27
5	☾	Sun r. 3. 50.	15	15	22	38	15	2	22	37	14	48	22	35	14	34	22	34
6	☿		16	13	22	45	15	59	22	43	15	45	22	42	15	32	22	40
7	☽		17	10	22	50	16	56	22	49	16	43	22	48	16	29	22	46
8	☿		18	7	22	56	17	54	22	54	17	40	22	53	17	26	22	52
9	☽		19	5	23	1	18	51	23	0	18	37	22	58	18	24	22	57
10	☿		20	2	23	5	19	48	23	5	19	35	23	3	19	21	23	3
11	☽		20	59	23	10	20	46	23	8	20	32	23	7	20	18	23	7
12	☿	Sun r. 3. 48.	21	58	23	13	21	43	23	12	21	29	23	11	21	16	23	10
13	☽		22	54	23	16	22	40	23	15	22	26	23	14	22	13	23	14
14	☿		23	51	23	20	23	38	23	18	23	24	23	18	23	10	23	17
15	☽		24	49	23	22	24	35	23	21	24	21	23	21	24	7	23	20
16	☿		25	46	23	23	25	32	23	23	25	18	23	22	25	5	23	22
17	☽		26	43	23	25	26	29	23	25	26	16	23	24	26	2	23	24
18	☿		27	40	23	26	27	27	23	26	27	13	23	26	26	59	23	25
19	☽		28	38	23	27	28	24	23	27	28	10	23	27	27	56	23	27
20	☿		29	36	23	28	29	21	23	27	29	7	23	27	28	53	23	28
21	☽	Sol in Cancer	29	33	23	28	29	19	23	27	29	4	23	28	29	51	23	28
22	☿	Sun r. 3. 47	1	27	23	27	1	15	23	27	1	4	23	27	50	23	28	
23	☽		2	26	23	26	2	13	23	26	1	59	23	27	1	45	23	27
24	☿	John Baptist.	3	24	23	25	3	10	23	25	2	56	23	26	2	42	23	26
25	☽		4	21	23	23	4	7	23	24	3	53	23	24	3	40	23	24
26	☿		5	18	23	21	5	4	23	22	4	52	23	22	4	37	23	23
27	☽	Brightest in the Harp.	6	15	23	19	6	2	23	20	5	48	23	21	5	34	23	20
28	☿		7	12	23	17	6	59	23	16	6	45	23	18	6	31	23	18
29	☽	Peter Apostle	8	10	23	13	7	56	23	13	7	42	23	14	7	28	23	15
30	☿		9	7	23	10	8	53	23	10	8	40	23	11	8	26	23	11

Month	Week Days	Remarkable days, and four- thing of Stars at midnight.	Leap	Year First		Year	Second	Year	Third	Year
			1784	1788	1785	1789	1786	1790	1787	1791
			1792	1796	1793	1797	1794	1798	1795	1799
			☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec
			D M	D M	D M	D M	D M	D M	D M	D M
			☿	North	☿	North	☿	North	☿	North
1	☿		10 4	23 5	9 50	23 6	9 37	23 7	9 23	23 8
2	☿		11 1	23 1	10 48	23 1	10 34	23 2	10 20	23 3
3	☿		11 58	22 55	11 45	22 56	11 31	22 58	11 17	23 0
4	☿		12 56	22 50	12 42	22 51	12 28	22 52	12 14	22 54
5	☿		13 53	22 44	13 39	22 45	13 25	22 47	13 12	22 48
6	☿		14 50	22 38	14 36	22 38	14 23	22 41	14 9	22 42
7	☿	Sun. r. 3. 53.	15 47	22 31	15 34	22 33	15 20	22 35	15 6	22 36
8	☿		16 44	22 24	16 31	22 26	16 17	22 29	16 3	22 30
9	☿		17 42	22 17	17 28	22 20	17 14	22 21	17 0	22 23
10	☿		18 39	22 10	18 25	22 11	18 12	22 13	17 58	22 15
11	☿	Sun r. 3. 38.	19 36	22 1	19 22	22 3	19 9	22 5	18 55	22 7
12	☿		20 34	21 53	20 20	21 55	20 6	21 58	19 52	21 58
13	☿		21 31	21 44	21 17	21 46	21 3	21 49	20 49	21 51
14	☿		22 28	21 35	22 14	21 37	22 1	21 40	21 47	21 42
15	☿		23 25	21 26	23 11	21 28	22 58	21 30	22 44	21 32
16	☿		24 22	21 16	24 9	21 18	23 55	21 20	23 41	21 23
17	☿		25 20	21 6	25 6	21 8	24 52	21 1	24 38	21 13
18	☿		26 17	20 55	26 3	20 57	25 49	21 0	25 36	21 2
19	☿		27 14	20 44	27 1	20 46	26 47	20 46	26 33	20 51
20	☿		28 11	20 32	27 58	20 35	27 44	20 38	27 31	20 41
21	☿	Sun r. 4. 4.	29 10	20 20	28 55	20 24	28 41	20 26	28 27	20 28
22	☿	Sol in Leo.	☿ 7	20 9	29 52	20 11	29 39	20 15	29 25	20 17
23	☿		1 3	19 56	☿ 50	20 0	☿ 37	20 2	☿ 22	20 5
24	☿		2 1	19 44	1 47	19 47	1 33	19 50	1 19	19 53
25	☿	James Apostle	2 58	19 31	2 44	19 34	2 30	19 37	2 17	19 40
26	☿		3 55	19 17	3 42	19 21	3 28	19 24	3 14	19 27
27	☿	Sun r. 4. 16.	4 53	19 4	4 39	19 7	4 25	19 10	4 12	19 14
28	☿	Swan's Tail.	5 50	18 50	5 36	18 53	5 23	18 56	5 9	19 1
29	☿		6 48	18 35	6 34	18 39	6 20	18 42	6 6	18 46
30	☿	Dog's days be.	7 45	18 21	7 31	18 24	7 17	18 28	7 4	18 31
31	☿		8 42	18 6	8 20	18 9	8 15	18 13	8 2	18 17

August hath XXXI Days.

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Month	Week Days	Remarkable days, and fouthing of Stars at Midnight.	Leap 1784 1792		Year First 1788 1796		Year Second 1786 1797		Year Third 179 1798		Year Fourth 1787 1795		Year Fifth 1791 1799	
			☉ pla		☉ dec		☉ pla		☉ dec		☉ pla		☉ dec	
			D	M	D	M	D	M	D	M	D	M	D	M
			☉		North.		☉		North.		☉		North.	
1	E	Lammas.	9	40	17	51	9	34	17	54	9	12	17	59
2	G	Sun r. 4 20.	10	37	17	35	10	31	17	38	10	10	17	42
3	E		11	35	17	20	11	30	17	23	11	7	17	27
4	F		12	33	17	3	12	28	17	7	12	6	17	11
5	G		13	31	16	47	13	15	16	50	13	3	16	54
6	A		14	28	16	30	14	13	16	34	14	1	16	38
7	B		15	25	16	13	15	10	16	17	14	58	16	22
8	C		16	23	15	57	16	8	15	59	15	55	16	5
9	D		17	20	15	39	17	5	15	42	16	53	15	47
10	E		18	18	15	21	18	3	15	25	17	51	15	30
11	F	Sun r. 4 35	19	15	15	3	19	1	15	7	18	48	15	12
12	G		20	13	14	45	20	1	14	49	19	46	14	54
13	A	Sun r. 4 39.	21	11	14	27	20	57	14	31	20	43	14	36
14	B		22	9	14	8	21	55	14	12	21	41	14	17
15	C		23	6	13	50	22	51	13	53	22	38	13	58
16	D		24	4	13	30	23	48	13	34	23	36	13	40
17	E		25	2	13	11	24	47	13	15	24	34	13	21
18	F		25	59	12	52	25	45	12	50	25	33	13	1
19	G		26	57	12	32	26	43	12	36	26	30	12	42
20	A		27	55	12	12	27	40	12	16	27	27	12	22
21	B	Sun r. 4 43.	28	53	11	52	28	38	11	56	28	25	12	2
22	C		29	51	11	32	29	36	11	36	29	23	11	42
23	D	Sol. in Virgo	☉	49	11	11	☉	35	11	15	☉	21	11	21
24	E	Barthol. Ap.	1	47	10	51	1	32	10	55	1	19	11	1
25	F		2	45	10	30	2	30	10	34	2	17	10	40
26	G		3	44	10	9	3	28	10	13	3	15	10	20
27	A		4	41	9	47	4	26	9	52	4	13	9	58
28	B		5	39	9	27	5	24	9	31	5	11	9	37
29	C		6	37	9	5	6	22	9	9	6	9	9	11
30	D	Sun r. 5 31.	7	35	8	44	7	20	8	48	7	7	8	54
31	E		8	33	8	22	8	18	8	26	8	5	8	32

Month	Week Days	Remarkable days, and four- thing of Stars at Midnight	Leap	Year		Year	Year		Second	Year		Third	Year	
			1784	1788	1785	1789	1786	1790	1787	1791				
			1792	1796	1793	1797	1794	1798	1795	1799				
			☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec
			D	M	D	M	D	M	D	M	D	M	D	M
			☉	North	☉	North	☉	North	☉	North	☉	North	☉	North
1	f	Fomelhaut	9	31	8	0	9	17	8	5	9	3	8	11
2	g	London b. 66	10	30	7	38	10	16	7	43	10	2	7	48
3	a	First in Pega-	11	28	7	16	11	14	7	21	11	1	7	27
4	B	fus's Wing.	12	26	6	54	12	12	7	0	11	58	7	5
5	E		13	25	6	31	13	10	6	37	12	56	6	42
6	D		14	22	6	9	14	9	6	14	13	55	6	20
7	E	Sun r. 5. 28.	15	22	5	46	15	7	5	52	14	53	5	57
8	f	Dog's days en	16	20	5	24	16	6	5	30	15	51	5	35
9	g	Sun r. 5. 35.	17	18	5	1	17	4	5	6	16	50	5	12
10	a		18	16	4	38	18	2	4	44	17	49	4	50
11	B		19	15	4	15	19	1	4	21	18	47	4	26
12	E		20	13	3	52	19	59	3	58	19	45	4	3
13	D		21	12	3	29	20	58	3	35	20	44	3	40
14	E		22	10	3	6	21	56	3	12	21	42	3	17
15	f		23	9	2	42	22	55	2	48	22	41	2	54
16	g		24	8	2	20	23	53	2	25	23	39	2	31
17	a	Sun r. 5. 49.	25	6	1	56	24	52	2	2	24	38	2	8
18	B		26	5	1	33	25	51	1	39	25	37	1	44
19	E		27	4	1	10	26	50	1	15	26	35	1	21
20	D	Andro. head	28	3	0	46	27	48	0	53	27	34	0	58
21	E	MathewEvan	29	2	0	23	28	47	0	28	28	33	0	34
22	f	Sun r. 6. 0 }	29	58	Sou	1	29	46	0	5	29	31	0	11
23	g	Sol in Libra }	30	57	0	23	30	44	Sou	17	30	30	Sou	12
24	a	End of Pega-	1	57	0	46	1	44	0	41	1	30	0	35
25	B	fus's Wing.												
26	E		2	57	1	10	2	43	1	5	2	28	0	59
27	D		3	56	1	33	3	41	1	28	3	27	1	22
28	E	Sun r. 6. 19.	4	55	1	57	4	40	1	51	4	26	1	46
29	f		5	54	2	20	5	40	2	14	5	31	2	8
30	g	St Michael	6	53	2	44	6	39	2	38	6	24	2	32
			7	52	3	7	7	38	3	2	7	23	2	56

October hath XXXI Days.

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Month	Week	Days	Remarkable Days, and Sighting of Stars at Midnight.	Leap		Year		Year		Year		Year		Year			
				1784	1792	1788	1796	1785	1793	1786	1794	1790	1787	1791	1799		
				☉	♁	☉	♁	☉	♁	☉	♁	☉	♁	☉	♁	☉	♁
				D	M	D	M	D	M	D	M	D	M	D	M		
				♈	♈	♈	♈	♈	♈	♈	♈	♈	♈	♈	♈		
				♈	♈	♈	♈	♈	♈	♈	♈	♈	♈	♈	♈		
1	A		Sun r. 6. 13.	8	51	3	31	8	36	3	25	8	23	3	20	8	9
2	B			9	51	3	54	9	36	3	48	9	22	3	44	9	8
3	C			10	50	4	17	10	35	4	12	10	21	4	6	10	7
4	D			11	49	4	40	11	34	4	35	11	20	4	30	11	6
5	E		Pole Star.	12	48	5	3	12	34	4	58	12	19	4	52	12	6
6	F			13	47	5	27	13	33	5	21	13	19	5	15	13	5
7	G			14	47	5	50	14	32	5	44	14	18	5	38	14	4
8	A		Southernmost in Androme- da's Girdle.	15	46	6	12	15	31	6	7	15	17	6	1	15	3
9	B			16	45	6	35	16	31	6	30	16	17	6	24	16	2
10	C		Sun. r. 6. 29.	17	44	6	58	17	30	6	53	17	16	6	47	17	2
11	D			18	44	7	21	18	30	7	15	18	16	7	10	18	2
12	E		Sun r. 6. 35.	19	44	7	43	19	29	7	38	19	15	7	32	19	1
13	F			20	43	8	6	20	29	8	1	20	15	7	56	20	1
14	G			21	43	8	28	21	29	8	23	21	14	8	17	21	1
15	A			22	43	8	50	22	28	8	45	22	14	8	40	21	59
16	B			23	42	9	12	23	28	9	7	23	14	9	2	22	59
17	C			24	41	9	34	24	28	9	30	24	13	9	24	23	59
18	D		Luke Evan.	25	41	9	56	25	27	9	51	25	13	9	46	24	59
19	E			26	41	10	18	26	27	10	13	26	12	10	8	25	58
20	F			27	41	10	40	27	27	10	34	27	12	10	30	26	58
21	G		Sun r. 6. 52.	28	41	11	1	28	27	10	56	28	12	10	51	27	58
22	A		Andromeda's	29	41	11	22	29	27	11	17	29	12	11	12	28	58
23	B		Southernmost	30	41	11	43	30	26	11	38	30	12	11	33	29	58
24	C		Foot.	1	41	12	4	1	26	12	0	1	12	11	54	30	57
25	D		Sol in Scorpio														
26	E		Sun r. 7. 4.	2	41	12	25	2	26	12	20	2	12	12	15	1	57
27	F			3	41	12	40	3	26	12	40	3	12	12	35	2	57
28	G		Simon & Jude	4	41	13	5	4	26	13	1	4	12	12	56	3	57
29	A			5	41	13	25	5	26	13	21	5	12	13	16	4	57
30	B		Sun r. 7. 10.	6	41	13	45	6	26	13	41	6	12	13	36	5	57
31	C			7	41	14	5	7	26	14	1	7	12	13	56	6	57
				8	41	14	24	8	26	14	20	8	12	14	15	7	58

Month	Week Days	Remarkable days, and fouthing of Stars at Midnight.	Leap 1784 1792		Year 1788 1796		First 1785 1793		Year 1789 1797		Second 1786 1794		Year 1790 1798		Third 1787 1795		Year 1791 1799	
			☉ pla		☉ dec		☉ pla		☉ dec		☉ pla		☉ dec		☉ pla		☉ dec	
			D	M	D	M	D	M	D	M	D	M	D	M	D	M	D	M
			♐		North		♐		North		♐		North		♐		North	
1	D	All Saints.	9	41	14	44	9	26	14	40	9	12	14	34	8	58	14	30
2	E	Sun r. 7. 14.	10	41	15	2	10	26	14	58	10	12	14	53	9	58	14	49
3	F		11	41	15	21	11	27	15	17	11	13	15	12	10	58	15	8
4	G	K. Will. Nat.	12	42	15	40	12	27	15	35	12	13	15	31	11	58	15	26
5	A	Powder Plot.	13	42	15	58	13	27	15	53	13	13	15	50	12	58	15	45
6	B		14	42	16	16	14	28	16	11	14	13	16	7	13	59	16	3
7	C		15	43	16	33	15	28	16	30	15	14	16	25	14	59	16	21
8	D		16	43	16	51	16	28	16	46	16	14	16	42	15	59	16	38
9	E		17	44	17	8	17	29	17	4	17	14	17	0	17	1	16	56
10	F	Sun r. 7. 29.	18	44	17	25	18	29	17	21	18	15	17	17	18	1	17	13
11	G	Martin B.	19	44	17	41	19	30	17	37	19	15	17	33	19	1	17	30
12	A		20	45	17	57	20	30	17	53	20	16	17	50	20	1	17	46
13	B	Sun r. 7. 54.	21	45	18	13	21	31	18	9	21	16	18	6	21	2	18	2
14	C		22	46	18	29	22	31	18	25	22	17	18	21	22	2	18	17
15	D		23	46	18	44	23	32	18	40	23	17	18	37	23	3	18	33
16	E		24	47	18	59	24	32	18	55	24	18	18	52	24	3	18	48
17	F		25	48	19	13	25	33	19	10	25	18	19	6	25	4	19	3
18	G		26	48	19	27	26	34	19	24	26	19	19	21	26	4	19	17
19	A		27	49	19	41	27	34	19	38	27	20	19	35	27	5	19	31
20	B		28	50	19	56	28	35	19	52	28	20	19	48	28	6	19	45
21	C		29	50	20	8	29	36	20	5	29	21	20	2	29	6	19	58
22	D	Sol. in Sagit.	30	51	20	21	30	36	20	18	30	22	20	15	30	7	20	12
23	E		1	52	20	33	1	37	20	0	1	23	20	27	1	8	20	24
24	F	Sun r 7. 47	2	53	20	45	2	38	20	42	2	23	20	40	2	9	20	36
25	G		3	54	20	57	3	39	20	54	3	24	20	51	3	10	20	48
26	A		4	54	21	8	4	39	21	5	4	25	21	3	4	10	21	0
27	B		5	55	21	20	5	40	21	16	5	26	21	14	5	11	21	11
28	C		6	56	21	30	6	41	21	27	6	27	21	24	6	12	21	22
29	D	Aldebaran	7	37	21	39	7	42	21	37	7	28	21	34	7	13	21	32
30	E	Andrew Ap.	8	58	21	50	8	43	21	46	8	28	21	44	8	14	21	42

December hath XXXI Days.

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Month	Week Days	Remarkable days, and southing of Stars at Midnight.	Leap	Year	First	Year	Second	Year	Third	Year
			1784	1788	1785	1789	1786	1790	1787	1791
			1792	1796	1793	1797	1794	1798	1795	1799
			☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec	☉ pla	☉ dec
			D M	D M	D M	D M	D M	D M	D M	D M
			♂	South	♂	South	♂	South	♂	South
1	♂	San. r. 7. 38.	10	0 21 58	9	43 21 56	9	29 21 53	9	14 21 51
2	♂		11	0 22 7	10	45 22 5	10	30 22 2	10	17 22 0
3	♂		12	1 22 15	11	46 22 13	11	31 22 2	11	11 22 8
4	♂		13	2 22 23	12	47 22 21	12	32 22 20	12	17 22 17
5	♂		14	3 22 30	13	48 22 28	13	33 22 27	13	18 22 25
6	♂		15	4 22 37	14	49 22 36	14	34 22 34	14	19 22 32
7	♂		16	5 22 44	15	50 22 42	15	35 22 41	15	20 22 40
8	♂		17	6 22 51	16	51 22 48	16	36 22 47	16	21 22 46
9	♂		18	7 22 56	17	52 22 54	17	37 22 53	17	22 22 52
10	♂		19	8 23 1	18	53 23 0	18	38 22 58	18	24 22 58
11	♂	Sun r. 8. 5.	20	9 23 6	19	54 23 5	19	39 23 3	19	25 23 2
12	♂	First in Ori- on's Belt.	21	10 23 10	20	55 23 9	20	40 23 8	20	26 23 7
13	♂		22	11 23 14	21	56 23 13	21	41 23 12	21	27 23 11
14	♂	Last in Ori- on's Belt.	23	12 23 17	22	57 23 16	22	43 23 15	22	28 23 15
15	♂		24	13 23 20	23	58 23 20	23	44 23 20	23	29 23 18
16	♂		25	14 23 22	24	59 23 22	24	45 23 21	24	31 23 21
17	♂	Orion's right	26	15 23 24	26	1 23 25	25	46 23 23	25	30 23 23
18	♂	shoulder and	27	17 23 26	27	2 23 25	26	47 23 23	26	32 23 25
19	♂	Auriga's right	28	18 23 27	28	3 23 27	27	48 23 26	27	33 23 26
20	♂	shoulder.	29	19 23 28	29	4 23 27	28	49 23 27	28	35 23 27
21	♂	Sun r. 8. 9.	20	20 23 28	20	5 23 28	29	51 23 28	29	36 23 28
22	♂	Thomas Ap- Sol in Capri.	1	21 23 28	1	6 23 27	20	52 23 27	20	37 23 27
23	♂		2	22 23 26	2	8 23 26	1	53 23 27	1	38 23 27
24	♂	Foot of g. Dog	3	24 23 25	3	9 23 25	2	54 23 26	2	39 23 26
25	♂	Nat. of Christ	4	25 23 24	4	10 23 24	3	55 23 24	3	40 23 24
26	♂	St. Stephen	5	26 23 21	5	11 23 21	4	56 23 22	4	42 23 22
27	♂	St. John Evan	6	27 23 18	6	12 23 19	5	58 23 20	5	43 23 20
28	♂	Innocents.	7	28 23 15	7	14 23 16	6	59 23 17	6	44 23 17
29	♂	Mouth of the	8	30 23 11	8	15 23 12	7	59 23 13	7	45 23 14
30	♂	great Dog or	9	32 23 7	9	16 23 8	9	1 23 10	8	46 23 10
31	♂	Syrius.	10	33 23 2	10	17 23 4	10	2 23 5	9	48 23 6

A TABLE of the Variation of the Sun's Declination to every
15 Degrees or every Hour from the Meridian of London.

Degrees of Longitude from the Meridian of LONDON.

Daily Vari.	Deg. 15	Deg. 30	Deg. 45	Deg. 60	Deg. 75	Deg. 90	Deg. 105	Deg. 120	Deg. 135	Deg. 150	Deg. 165	Deg. 180
	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	12 h.
min.	min.	min.	min.	min.	min.	min.	min.	min.	min.	min.	min.	min.
2	0	0	0	0	0	0	1	1	1	1	1	1
3	0	0	0	0	1	1	1	1	1	1	1	1
4	0	0	0	1	1	1	1	1	2	2	2	2
5	0	0	1	1	1	1	1	2	2	2	2	2
6	0	0	1	1	1	1	2	2	2	2	3	3
7	0	0	1	1	1	2	2	2	3	3	3	3
8	0	1	1	1	2	2	2	3	3	3	4	4
9	0	1	1	1	2	2	3	3	3	4	4	4
10	0	1	1	2	2	2	3	3	4	4	5	5
11	0	1	1	2	2	3	3	4	4	4	5	5
12	0	1	1	2	2	3	3	4	4	4	5	6
13	1	1	2	2	3	3	4	4	5	5	6	6
14	1	1	2	2	3	3	4	5	5	6	6	7
15	1	1	2	3	3	3	4	5	6	6	7	7
16	1	1	2	3	3	3	5	5	6	7	7	8
17	1	1	2	3	4	4	5	6	6	7	8	8
18	1	2	2	3	4	4	5	6	7	7	8	9
19	1	2	2	3	4	5	6	6	7	8	9	9
20	1	2	2	3	4	5	6	7	7	8	9	10
21	1	2	3	3	4	5	6	7	8	9	10	10
22	1	2	3	4	5	5	6	6	8	9	10	11
23	1	2	3	4	5	6	7	7	9	10	11	11
24	1	2	3	4	5	6	7	7	9	10	11	12

IN every Page there are 11 Columns, the first shews the Day of the Month, the second the Day of the Week, expressed by the Letters A, B, C, &c. the third the Southing of several Stars at Midnight, at which Time the said Stars may (in the Absence of the Moon, and Weather permitting) be observed, thereby to find the Latitude; in the same Column is given the Time of Sun-rising, (and by subtracting the Time of rising from 12 Hours gives the Time of setting) the Eight following Columns shew the Sun's Place and Declination for Leap-Year, and the first and Second and Third Year after, according to their respective Titles.

The following Table is inserted, where, by Inspection, the Year sought is more readily found.

Leap Year.	First Year.	Second Year.	Third Year.
1784	1785	1786	1787
1788	1789	1790	1791
1792	1793	1794	1795
1796	1797	1798	1799
1804	1805	1806	1807
1808	1809	1810	1811
1812	1813	1814	1815
1816	1817	1818	1819

Note, The Year 1800 is to be a common Year.

The Use of the CALENDAR.

To find the Day of the Week or Month for any Time past, or to come, by the Calendar.

First, Find the Dominical Letter for the Year, then proceed as follows.

Example 1. Suppose it be required to find what Day of the Month will be the third *Wednesday* in *March*, 1793.

Having found the Dominical Letter by the Directions in Page 22, or by the Table in Page 39, to be F, turn to the Month of *March*, and account F for *Sunday*, then the Letter B is for *Wednesday*, and the Third *Wednesday* is the 16th of *March*, which was required.

Example 2. What Day of the Week will the second of *September* be on in the Year 1784?

This Year being Leap-Year has two Dominical Letters D and C; the first Letter, to wit, D, serving from the first of *January* to the End of *February*; the last Letter, to wit C, serves from thence to the Years end.

Wherefore looking against the second of *September*, there stands G, which represents *Saturday*, the Day of the Week required.

To find the Sun's Place and Declination by the Calendar.

Example 1. Suppose the Sun's Place and Declination be required on the 10th of *January*, 1788, being Leap-Year.

In the Month of *January* in the first Column look the Day of the Month, over against which, under Leap-Year stands 19.56, that is, the Sun's Place is in 19 deg. 56 min. of *Capricornus*: In the next Column under the said Year stands 21.58, under the Title South, which shews the Declination to be 21 deg. 58 min. Southerly; and this also will practically serve for the Year 1784, for the said 10th of *January*, being Leap-Year also.

Example 2. Suppose the Sun's Place and Declination is required on the 10th of *March*, 1786, being the second after Leap-Year.

In the Month of *March*, in the first Column find the Day of the Month, over-against which, under Second Year, stands 20.3 which shews the Sun's Place to be in 20 deg. 3 min. of *Pisces*; and in the next Column under Second Year, stands 3.56, which shews the Declination to be 3d. 56m. Southerly, which was required.

Although it is common to take the Declination as it is in the Calendar, yet if the Difference of Longitude be considerable from *London*, or at any other Time than Noon, it is requisite the Declination should be corrected, because in the Calendar it is calculated for Noon under the Meridian of *London*, for which End the *Table of the Variation of the Sun's Declination to every Hour or 15 Degrees of Longitude from the Meridian of London*, is added in Page 52.

IN the first Column of this Table is the daily Variation, which is found by subtracting the Declination of the given Day of the Month found in the Calendar, from the Declination for the Day following: or contrarily this from that, that is, the less from the greater, and the Difference is the daily Variation: In the Head of the other Columns are Degrees of Longitude from *London*, either Easterly or Westerly, or the Hours before or after Noon, and in those Columns under the respective deg. of Longitude, or Hour, are the Minutes of the Declination, answerable to the daily Variation: As suppose the daily Variation was 10 min. and the Difference of Longitude 90 deg. or 6 Hours, against 10 in the first Column, and under 90 deg. at the Head of the Table, stands 2 Minutes answering thereunto, and are to be used as follows.

The Use of the Table of the Variation of the Sun's Declination.

The Rule. First, If the Longitude be Westerly, or the Hour after Noon, and the Declination increasing, the Variation found in this Table must be added to the Declination found in the Calendar; but if the Declination be decreasing, it must be subtracted therefrom.

Secondly, If the Difference of Longitude be Easterly, or the Hour before Noon, and the Declination increasing, the Variation aforesaid must be subtracted; but the Declination decreasing, it must be added.

Example 1. *April* the 19th, 1780, being at Sea, the Difference of Longitude from the Meridian of *London*, 90 degrees Westerly, or 6 Hours after

after Noon, I find the Declination in the Calendar to be 11 deg. 28 min. North; and the 20th Day, the Declination is 11 deg. 48 min. therefore subtracting the less Declination from the greater, the Remainder is 20 min. which is the daily Increase; Then in the Table under 90 deg. and over against 20, stands 5 min. (which because the Difference of Longitude is Westerly, and the Declination increasing) must be added to 11 deg. 28 min. before found, which makes the true Declination 11 deg. 33 min. North.

If the Difference of Longitude in this Case had been Easterly, the 5 min. found in the Table must have been subtracted.

Note. It is easily discerned, whether the Declination increases or decreases, by observing whether the Declination for the Day following be greater or less: For if it be greater, then it increases, but if less, then it decreases.

Example 2. January the 25th, 1787, being at Sea, the Difference of Longitude from London, 120 deg. Westerly: I find the Declination in the Calendar to be 18 deg. 55 min. South, and the 26th Day it is 18 deg. 40 min. therefore subtracting the lesser from the greater, the Difference is 15 min. which is the daily decrease; then in this Table under 120 deg. and against 15 stands 5 min. (which because the Difference of Longitude is Westerly, and the Declination decreasing) must be subtracted, which makes the true Declination 18 deg. 50 min. South: If the Difference of Longitude had been Easterly, the 5 min. must have been added.

The Use of the Sun's Declination to find the Latitude.

The Knowledge of the Sun's Declination at any Time, and in any Longitude, is of great Importance at Sea, for by this, and the Complement of the Sun's Meridian Altitude (commonly called the Zenith Distance) taken with a Quadrant, is found the Latitude of the Place the Ship is then in; to perform which take the following Rules.

Rule 1. If the Sun comes to the Meridian in the South, and the Declination be North, then the Declination added to the Complement of the Meridian Altitude is the Latitude, North.

Example. Suppose at Sea, the 10th of April, 1788, the Declination found by the Table is 8 deg. 16 min. North, the Sun comes to the Meridian in the South; the Complement of the Meridian Altitude by Observation is 23 deg. 10 min. What is the Latitude?

Complement of the Meridian Altitude is	- - 23	10	South
Declination of the Sun is	- - - - -	8	16 North

The Latitude of the Place is	- - - - -	31	26 North
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Rule 2. If the Sun comes to the Meridian in the North, and hath North Declination, then subtract the Complement of the Meridian Altitude from the Declination, the Remainder is the Latitude, North: But if the Complement of the Altitude exceed the Declination, subtract the Declination therefrom, and the Remainder is the Latitude, South.

Example 1. Suppose at Sea, May 20, 1788, the Declination being 20 deg. 9 min. North, the Sun comes to the Meridian in the North, and by observing with a Quadrant the Sun's Zenith Distance is 18 deg. 42 min. What is the Latitude of the Place?

Sun's

Sun's Declination is _____ 20d. : 9m. North

The Sun's Zenith Distance _____ 18d. : 42m. North

The Latitude is _____ 1d. : 27m. North

Example 2. At Sea, *June* 10th, 1784, the Sun's Declination by the Table is 23 deg. 6 min. North, the Complement of the Meridian Altitude by Observation is 33 deg. 10 min. the Sun comes to the Meridian in the North.

Complement of the Sun's Meridian Altitude is _____ 33d. : 10m. North

Sun's Declination _____ 23d. : 6m. North

The Latitude is _____ 10d. : 4m. North

Rule 3. If the Sun comes to the Meridian in the North, and hath South Declination, the Declination added to the Complement of the Altitude is the Latitude, South.

Example 3. At Sea, *January* 29th, 1784, the Sun comes to the Meridian in the North, the Complement of the Meridian Altitude is 22 deg. 10 min. What is the Latitude?

Complement of the Sun's Meridian Altitude is _____ 22d. : 10m. North

Sun's Declination is _____ 17d. : 57m. South

The Latitude is _____ 40d. : 7m. South

Rule 4. If the Sun comes to the Meridian in the South, and hath South Declination, subtract the Complement of the Meridian Altitude from the Declination, the Remainder is the Latitude South: But if the Complement of the Meridian Altitude exceeds the Declination, subtract the Declination therefrom, the Remainder is the Latitude, North.

Example 1. At Sea, *January* 1st, 1784 the Sun cometh to the Meridian in the South: The Complement of the Meridian Altitude is 10 deg. 36 min. What is the Latitude?

Sun's Declination _____ 23d. : 2m. South

Complement of Meridian Altitude _____ 10d. : 36m. South

Latitude of the Place _____ 12d. : 26m. South

Example 2. At Sea, *February* 18th, 1784, the Sun cometh to the Meridian in the South, the Complement of the Meridian Altitude is 25 deg. 20 min. What is the Latitude?

Complement of the Sun's Meridian Altitude _____ 25d. : 20m. South

Sun's Declination _____ 11d. : 38m. South

Latitude _____ 13d. : 42m. North

Rule 5. If the Sun or Star observed be in the (Zenith, that is, right over Head) and has either North or South Declination, that Declination is the Latitude either North or South agreeable to the Name.

Rule 6. If the Sun or Star observed hath no Declination, the Complement of the Meridian Altitude is the Latitude, and is North or South, according as the Ship is to the Northwards or Southwards of the Sun.

A Table of the Sun's Right Ascension.

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	<i>Jan.</i>		<i>Feb.</i>		<i>March</i>		<i>April</i>		<i>May</i>		<i>June</i>	
Days	☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.	
	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.
1	18	49	21	1	22	50	0	43	2	34	4	37
2	18	53	21	5	22	54	0	47	2	38	4	41
3	18	58	21	9	22	57	0	50	2	42	4	45
4	19	2	21	13	23	1	0	55	2	46	4	49
5	19	6	21	17	23	5	0	58	2	50	4	53
6	19	11	21	21	23	8	1	1	2	53	4	57
7	19	15	21	25	23	12	1	5	2	57	5	1
8	19	19	21	29	23	16	1	9	3	1	5	6
9	19	24	21	33	23	19	1	12	3	5	5	10
10	19	29	21	37	23	23	1	16	3	9	5	14
11	19	32	21	41	23	27	1	20	3	13	5	18
12	19	37	21	45	23	31	1	24	3	18	5	22
13	19	41	21	49	23	34	1	27	3	21	5	26
14	19	45	21	53	23	38	1	31	3	25	5	31
15	19	50	21	57	23	41	1	34		29	5	35
16	19	54	22	0	23	45	1	38	3	33	5	39
17	19	58	22	4	23	49	1	42	3	37	5	43
18	20	2	22	8	23	53	1	45	3	41	5	47
19	20	7	22	12	23	56	1	49	3	45	5	51
20	20	11	22	16	0	0	1	53	3	49	5	56
21	20	15	22	20	0	3	1	57	3	53	6	0
22	20	19	22	23	0	7	2	0	3	57	6	4
23	20	24	22	27	0	11	2	4	4	1	6	8
24	20	28	22	31	0	14	2	8	4	5	6	12
25	20	32	22	35	0	18	2	11	4	9	6	16
26	20	36	22	39	0	21	2	15	4	13	6	20
27	20	40	22	42	0	25	2	19	4	17	6	25
28	20	44	22	46	0	9	2	23	4	22	6	29
29	20	49			0	32	2	27	4	25	6	33
30	20	53			0	36	2	30	4	29	6	37
31	20	57			0	40			4	33		

Days	July		August		Septem.		October		Novem.		Decemb	
	☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.		☉ Right Ascen.	
	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.
1	6	41	8	46	10	42	12	30	14	27	16	31
2	6	45	8	50	10	46	12	34	14	31	16	35
3	6	49	8	54	10	49	12	38	14	35	16	39
4	6	54	8	57	10	53	12	41	14	39	16	44
5	6	58	9	1	10	57	12	45	14	43	16	49
6	7	2	9	5	11	0	12	49	14	46	16	52
7	7	6	9	9	11	4	12	52	14	50	16	57
8	7	10	9	13	11	7	12	56	14	54	17	1
9	7	15	9	17	11	11	13	0	14	58	17	6
10	7	18	9	21	11	15	13	3	15	3	17	10
11	7	22	9	24	11	18	13	7	15	7	17	14
12	7	26	9	28	11	22	13	11	15	11	17	18
13	7	30	9	32	11	25	13	14	15	15	17	22
14	7	35	9	36	11	30	13	18	15	19	17	27
15	7	39	9	39	11	33	13	22	15	23	17	32
16	7	43	9	43	11	36	13	25	15	27	17	36
17	7	47	9	47	11	40	13	29	15	31	17	41
18	7	52	9	51	11	43	13	33	15	35	17	45
19	7	55	9	54	11	47	13	37	15	40	17	50
20	7	59	9	58	11	51	13	41	15	44	17	54
21	8	3	10	2	11	54	13	44	15	48	17	59
22	8	7	10	6	11	58	13	48	15	52	18	3
23	8	11	10	9	12	1	13	52	15	56	18	8
24	8	15	10	13	12	5	13	56	16	1	18	12
25	8	19	10	18	12	9	14	0	16	5	18	17
26	8	23	10	20	12	12	14	3	16	10	18	21
27	8	27	10	24	12	16	14	7	16	13	18	25
28	8	30	10	28	12	19	14	11	16	18	18	29
29	8	34	10	31	12	23	14	15	16	22	18	34
30	8	38	10	35	12	27	14	20	16	26	18	39
31	8	42	10	39			14	23			18	43

A TABLE shewing the Right Ascension, Declination
and Magnitude of the Principal Fixed Stars.

Names of the Stars.	Magnit.	Right Ascen.		Declination	
		h.	m.	d.	m.
<i>E</i> N D of Pegasus's Wing, <i>Algenib</i> —————	2	0	2	13	59 N
<i>Pole Star</i> —————	2	0	49	88	9 N
<i>Gi</i> dle of <i>Andromeda</i> —————	2	0	57	34	27 N
<i>Bright Star in Aries</i> —————	2	1	54	22	24 N
<i>Medusa's Head, Algol</i> —————	2	2	52	40	5 N
<i>Bright fide of Perseus</i> —————	2	3	7	49	3 N
<i>Aldebaran, or Bull's Eye</i> —————	1	4	24	16	4 N
<i>Capella, or the Goat</i> —————	1	5	0	45	44 N
<i>Bright Foot of Orion, Rigel</i> —————	1	5	3	8	28 S
<i>Middle Star in Orion's Belt</i> —————	3	5	24	1	21 S
<i>Orion's Right Shoulder</i> —————	1	5	42	7	21 N
<i>Auriga's Right Shoulder</i> —————	2	5	43	44	54 N
<i>Bright Foot of Gemini</i> —————	2	6	24	16	35 N
<i>Syrius, or the Great Dog</i> —————	1	6	36	16	25 S
<i>Castor, or Northermost Twin</i> —————	2	7	19	32	21 N
<i>Procyon, or the Little Dog</i> —————	2	7	27	5	47 N
<i>Pollux, or Southermost Twin</i> —————	2	7	31	28	32 N
<i>Hydra's Heart</i> —————	1	9	16	7	43 S
<i>Lyon's Heart, or Regulus</i> —————	1	9	55	13	2 N
<i>The Lower of the Pointers</i> —————	2	10	48	57	33 N
<i>The Upper of the Pointers</i> —————	2	10	49	62	56 N
<i>Lyon's Tail, Deneb</i> —————	1	11	38	15	47 N
<i>Upper of the two last in □ of the Great Bear</i> —————	2	12	4	58	15 N
<i>Last but two in the Great Bear's Tail</i> —————	2	12	44	57	9 N
<i>Virgin's Spike</i> —————	1	13	13	10	6 S
<i>Last but one in the Great Bear's Tail</i> —————	2	13	15	56	4 N
<i>Last in the Great Bear's Tail</i> —————	2	13	38	50	25 N
<i>Arcturus</i> —————	1	14	5	20	83 N
<i>South Ballance</i> —————	2	14	38	15	7 S
<i>Foremost Guard</i> —————	2	14	49	75	3 N
<i>Brightest of the Crown</i> —————	2	15	25	27	28 N
<i>Brightest in the Serpent's Neck</i> —————	2	15	32	7	8 N
<i>Antares, the Scorpion's Heart</i> —————	1	16	15	25	55 S
<i>Head of Hercules</i> —————	3	17	4	14	40 N
<i>Ophiucus, or Serpent's Head</i> —————	3	17	24	12	45 N
<i>Lyra, or the Harp</i> —————	1	18	29	38	34 N
<i>Swan's Bill</i> —————	3	19	21	27	29 N
<i>Vulture, or Eagle's Heart</i> —————	2	19	40	8	18 N

A Table of the Fixed Stars.

Swan's Tail	2	20	33	44	30	N
Mouth of Pegasus	3	21	32	8	52	N
Fomelbaut	1	22	44	30	46	S
Marchab, or Pegasus's Wing	2	22	53	14	1	N
Scheat, or Pegasus's Leg	2	22	53	26	53	N
Cepheus's Knee	3	23	24	76	30	N
Andromeda's Head	2	23	56	27	42	N

The Explanation and Use of the Table of the Sun's Right-Ascension, and of the Table of the Stars Right Ascension and Declination.

IN the Table of the Sun's Right Ascension, the first Page contains the first six Months of the Year; the next Page the other six Months; at the Head of the Table are the Months; in the first Column towards the Left-hand are the Days of the Month, and in the opposite Column is the Right Ascension in Hours and Minutes.

In the Table of the Fixed Stars, there are four Columns; in the first towards the Left hand, are the Names of the Stars; in the second, the Star's Magnitudes; in the third, the Right Ascension in Hours and Minutes; in the fourth, their Declination in Degrees and Minutes, North or South.

First, To find the Time of a Star's coming upon the Meridian.

The Rule. Look the Right Ascension of the Sun and Star, and subtract the Right Ascension of the Sun from the Right Ascension of the Star, but if the Star's Right Ascension be less than the Sun's, add thereto 24 Hours, and then subtract; the Remainder after Subtraction, is the Time of the Star's coming upon the Meridian from Noon; but if the Remainder exceed 12 Hours, subtract 12 Hours therefrom, and then the Remainder is the Time from Midnight.

Example 1. Suppose the Time that *Fomelbaut* comes upon the Meridian on the 21st of *October* is required.

I find in the Table that Star's Right Ascension to be 22 Hours 44 min. and the Sun's to be 13 Hours 44 min. which subtracted from the Star's Right Ascension, leaves 9 Hours 00 min. the Time of the Star's coming upon the Meridian, Afternoon.

Example 2. Suppose the Time that the *Bull's Eye* comes upon the Meridian on the 26th of *October* was required.

I find the Star's Right Ascension to be 4 Hours 24 min. the Sun's 14 Hours 3 min. Now because the Sun's Right Ascension is more than the Stars, add to the Star's Right Ascension 24 Hours, which makes 28 Hours 24 min. from which subtracting the Sun's Right Ascension 14 Hours 3 min. there remains 14 Hours 21 min. from which subtracting 12 Hours, there remains 2 Hours 21 min. which is the Time of the Star's Southing after Midnight, as was required.

Secondly, The Time being given, to find what Star will come to the Meridian about the same Time?

The

The Rule. To the Sun's Right Ascension, add the Time from Noon, at which the Star's coming to the Meridian is desired; the Sum is the Right Ascension of the Star that will come to the Meridian at that Time; with which enter the Table of the Star's Right Ascension and Declination, where look what Star's Right Ascension agrees with the Right Ascension before found, or nearest thereto, and that is the Star sought for.

Example. Suppose April the 7th, I desire to know what Star will come upon the Meridian about 8 at Night.

The Sun's Right Ascension is 1 Hour 5 Minutes; the Time from Noon is 8 Hours, which added to the Sun's Right Ascension, makes 9 Hours 5 Minutes; the nearest in the Table is *Hydra's-Heart*, whose Right Ascension is 9 Hours 16 Minutes, and therefore Souths at 8 Hours nearly, and so in others.

Directions for observing the Stars, to find the Latitude of the Place.

Having before shewn how to find the Time of the Star's coming to the Meridian, I shall now shew, by the Stars Altitude, how to find the Latitude.

Note, In North Latitude, those Stars whose North Declination exceed the Complement of that Latitude may be observed under the Pole, and the same may be performed by the Southern Stars in South Latitude.

Particular Directions for finding the Latitude, by the Meridian Altitude of the fixed Stars.

Rule 1. If the Star comes to the Meridian in the South, and hath North Declination, the Complement of the Meridian Altitude or Zenith Distance, (by Observation) added to the Declination of the Star, found in the Table of the Star's Right Ascension and Declination, gives the Latitude North.

Example. On the 21st of January, being at Sea, I find by the foregoing Directions, that the *Lyon's-Heart* comes to the Meridian in the South, about 1 Hour 40 min. after Midnight; the Meridian Altitude by Observation was 63 Degrees; which subtract from 90 deg. there remains 27 deg. the Complement of the Altitude; to which adding 13 deg. 2 min. the Declination of the Star North, gives 40 deg. 2 min. the Latitude of the Place North, which was required.

Rule 2. If a Star comes to the Meridian in the South, and hath South Declination, subtract the Declination from the Complement of the Altitude, and the Remainder is the Latitude North: But if the Declination exceed the Complement of the Altitude, subtract the Complement of the Altitude therefrom, and the Remainder is the Latitude South.

Example 1. Suppose on the 21st of July, being at Sea, the Star *Fomalhaut* cometh to the Meridian in the South, at 2 Hours 41 min. after Midnight, the Merid. Alt. 35 deg. 50 min. the Comp. whereof is 54 deg. 10 min. the Star's Declination is 30 deg. 46 min. South, which subtracted from the Complement of the Alt. leaves 23d. 24m. which is the Latitude North.

Example 2. Suppose on the first of *July*, being at Sea, the *Scorpion's Heart* comes to the Meridian in the South at 9 Hours 34 min. at Night, the Complement of the Altitude is 5 deg. 27 min. the Declination 25 deg. 55 min. South, from which subtracting the Complement of the Altitude, there remains 20 deg. 28 min. which is the Latitude, South.

Rule 3. If a Star comes to the Meridian in the North, above the Pole, and hath North Declination, subtract the Declination from the Complement of the Altitude, the Remainder is the Latitude South: But if the Declination exceeds the Complement of the Altitude, subtract the Complement of the Altitude therefrom, the Remainder is the Latitude, North.

Example 1. On the 22d of *June*, the *brightest in the Harp* comes to the Meridian in the North at 25 min. after Midnight, the Complement of the Altitude is 79 deg. from which subtracting the Declination, which is 38 deg. 34 min. North, there remains 40 deg. 26 min. which is the Latitude, South.

Example 2. On the 22d of *September*, *Andromeda's-Head* comes to the Meridian in the North about Midnight, the Complement of the Altitude is 7 deg. 10 min. which subtracted from the Declination 27 deg. 42 min. gives 20 deg. 32 min. which is the Latitude, North.

Rule 4. If a Star comes to the Meridian in the North, and hath South Declination, the Complement of the Altitude added to the Declination gives the Latitude, South.

Example. On the 23d of *December*, (*Syrius*, or the *Great Dog's Mouth*) comes to the Meridian in the North at 27 Minutes after Midnight, the Complement of the Altitude is 30 deg. to which adding 16 deg. 25 min. the Declination South, gives 46 deg. 25 min. the Latitude, South.

Rule 5. If a Star comes to the Meridian, under the Pole, then add the Complement of the Declination to the Meridian Altitude, the Sum is the Latitude either North or South, according to the Stars Declination.

Example. On the 21st of *March*, the *Pole Star* comes to the Meridian under the Pole at 49 min. after Midnight, the Meridian Altitude 44 deg. 30 min. the Complement of the Declination 1 deg. 151 min. which added together, gives 46 deg. 21 min. which is the Latitude, North.

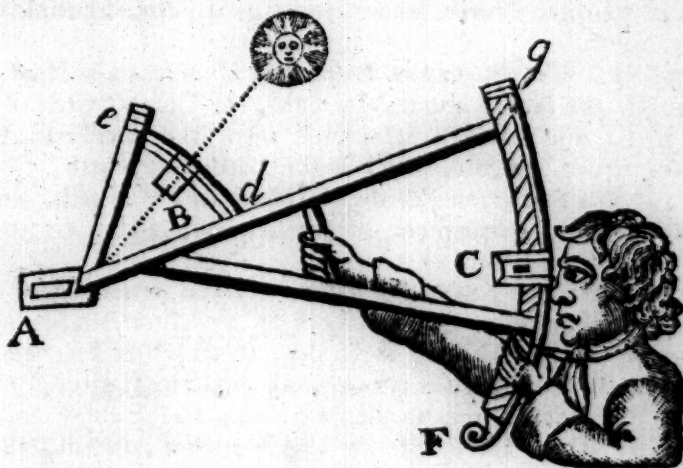
Rule 6. If a Star be in the Zenith, the Declination is the Latitude, either North or South, according to the Declination of the Star.

Rule 7. If the Star has no Declination, the Complement of the Meridian Altitude is the Latitude of the Place either North or South, according as the Observer is to the Northward or Southward of the Star.

The Description and Use of the Sea-Quadrant.

THIS Instrument consists of three Vanes and two Arches, the Horizon Vane, which in observing, respects the Horizon, as at A; the Shade Vane, so called, because of its giving the Shadow upon the Horizon Vane, in Time of Observation, as at B; besides this Shade Vane, there is another now in Use, having a Convex Glass properly fixed therein, which throws a lucid Point upon the Line of Direction in the Horizon Vane, and

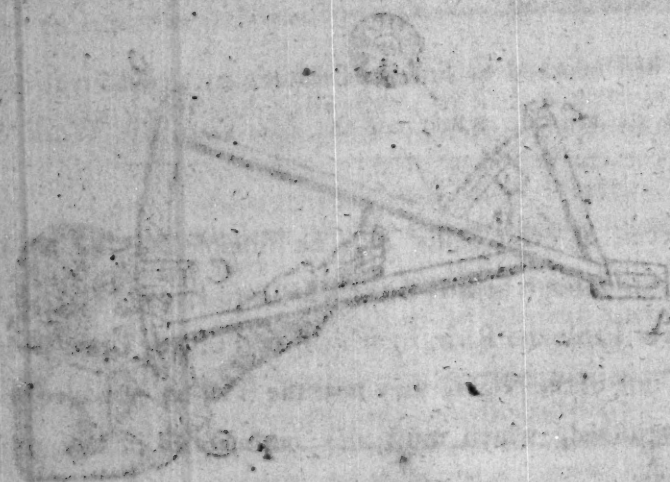
is of great Service in gloomy Weather, when the Rays of the Sun are too weak to produce a distinct Shadow, by the former ; (But the only Instrument for this Purpose, and far superior to any other now in Practice, is HADLEY's Quadrant ;) Lastly, the Sight Vane, which in Time of Observation is placed at the Eye, through which the Shadow (or lucid Point) and Horizon are seen, as at C. The lesser of the Arches mark'd with *d*, is called the Sixty-Arch, because it contains 60 (or more commonly of late 65) Degrees : In Time of Observation the Shade Vane is placed upon this Arch always to an even Degree ; it is numbered from the upper End at *e*, downwards to *d*, with 5, 10, 15, 20, &c. The bigger Arch marked with *g*, F, is called the Thirty-Arch, because it contains 30 (or rather 25) Degrees, and is divided into Degrees and Minutes.



The Use of this Instrument is to take the Sun's Meridian Altitude, which is done in the manner following.

Put the Horizon Vane upon the End of the Quadrant at A, the Shade Vane upon the Sixty (or lesser Arch) to a Number of Degrees, less than the Complement of the Altitude by 15 or 20d. and the Sight Vane upon the Thirty-Arch: The Vanes being thus fixed upon the Quadrant, your Back being turned to the Sun, and the Sight Vane placed to the Eye, look thro' the said Sight Vane, and cause the Shadow of the upper Edge of the Shade Vane (or lucid Point in the Glass Vane) to fall upon the upper Part of the Slit in the Horizon Vane, where usually (for Perspicuity-sake) there is drawn a black Line or Line of Direction ; and if at the same Time the Horizon appear thro' the said Slit in the Horizon Vane, you have then the Sun's present Altitude, or Zenith Distance ; but if the Sea appear instead of the Horizon, then slide the Sight Vane lower towards F ; if the Sky appear instead of the Horizon, then slide the Sight Vane a little higher until the Horizon appear thro' the Horizon Vane : But to obtain the Meridian Altitude

Altitude, (which is the greatest Altitude the Sun will have that Day, and is the Thing used to find the Latitude,) continue observing, and as the Sun rises, the Sea will appear through the Horizon Vane; then must the Sight Vane be removed lower: And thus continue observing, as often as may be convenient till the Sun be at the highest, which is the Meridian Altitude; When the Sun begins to fall, the Sky will appear instead of the Horizon, and then it is Time to give over observing for that Day: Having thus done, add the Degrees upon the Sixty Arch to the Degrees and Minutes upon the Thirty Arch, and the Sum is the Complement of the Meridian Altitude; the Use of which for finding the Latitude, is sufficiently shewn in the preceding Rules.



First,

Of finding the Latitude of a Place by the Altitude of the Pole-Star, taken by Hadley's Quadrant, or any other convenient Instrument, at any Hour of the Night.

FOR this Purpose a Nocturnal hath been generally used, but it is now partly by Time, and partly by being founded on bad Principles, become so faulty, as to cause an Error of near 40 Minutes in the Latitude, in some Circumstances, and therefore cannot be admitted in the present improved State of Navigation.

The best Method to find the Latitude by an Observation of any Star, is to take its Altitude when on the Meridian, and Work by the foregoing Rules.

However, as every Sailor may be supposed to be acquainted with the North Star, though he may be at a Loss to know others, I shall proceed to give a new Table and Rule, by which the Latitude of the Ship may be found at any Time of the Night, very near the Truth; provided the Horizon can be distinguished, which must also be supposed in any other Observation of the Stars.

The TABLE of the NORTH STAR.

Time the Star is distant from the nearest Meridian	Star above or below the Pole.	Time from the Meridian.	Star above or below the Pole.
Hours Minutes 0 0	Deg. Minutes 1 56	Hours Minutes 3 0	Deg. Minutes 1 22
0 15	1 56	3 15	1 17
0 30	1 55	3 30	1 11
0 45	1 54	3 45	1 5
1 0	1 52	4 0	0 58
1 15	1 50	4 15	0 51
1 30	1 47	4 30	0 44
1 45	1 44	4 45	0 37
2 0	1 40	5 0	0 30
2 15	1 36	5 15	0 1
2 30	1 32	5 30	0 2
2 45	1 27	5 45	0 7
3 0 0	1 22	6 00	0 0

The Use of the TABLE follows.

The RULE.

HAVING taken the Altitude of the Star, and noted the Time of Observation by your Watch, (kept as true as may be) correct it by Refraction and Dip of the Horizon, as shewn in the Mariner's Compass Rectified. This done, the next Thing is to find the Time of the Stars being on

on the Meridian above the Pole, by the Rule given in Page 60 of this Calendar: If the Time of Observation be not more than 6 Hours distant from the Time just found; (of the Star being on the Meridian above the Pole) the Distance of Time will in the Table give the Degrees and Minutes to be subtracted from the true Altitude of the Star, for the Altitude of the Pole, or Latitude of the Place. But if the Time of Observation be more than 6 Hours distant from the Meridian; it may be observed, that about 12 Hours before the Star is on the Meridian above the Pole, it was, and about 12 Hours after will be again on the Meridian below the Pole. Then enter the Table with the Distance of the Time of Observation, from the Time of the Stars transitting the Meridian below the Pole; and you'll see the Degrees and Minutes to be added for the Latitude required.

E X A M P L E.

Suppose the Altitude of the North Star was taken at Sea the Third of December, at 8 at Night, and found (Refraction and Dip of the Horizon being allowed) to be 52 deg. 10 min. What Latitude was the Ship in?

	Hour	Min.
The Right Ascension of the Star	6	49
Add	24	0
	24	49
Sun's Right Ascension, subtracted	16	39
The Star is on the Meridian above the Pole at	8	10 in the Evening.
Time of Observation	8	0
Time distant from the Meridian	0	10
	Deg.	Min.
Hence from the Altitude of the Star	52	10 N.
Subtract as by the Table nearest	1	56
Remains the Latitude required	50	14 N

But if the Time of Observation had been 4 o'Clock in the Morning, that Time is more than 6 Hours distant from the Time of transitting the Meridian above the Pole: Therefore we must consider that it was on the Meridian above the Pole at 8 Hours 10 Minutes at Night; it must have been on the Meridian below the Pole about 8 Hours 10 Minutes in the Morning; from which subtracting the Time of Observation 4 Hours, the distance of Time from the Meridian below the Pole is 4 Hours 10 Minutes, which in the Table gives 0 Degrees 55 Minutes, which added to 52 Degrees 10 Minutes gives the Latitude 53 Degrees 5 Minutes North.

THE FOLLOWING IS

A T A B L E

OF THE

Latitudes and Longitudes of Places,

ACCOUNTING THE

LONGITUDE from the Meridian of LONDON.

A Table of the Latitudes and Longitudes of Places, accounting the Longitude from the Meridian of L O N D O N.

Note, When the Latitude and Longitude of an Island is given, the middle of the Island is meant, except some particular Part of it is expressed.

Places Names.	Latitude North	Longit. E. or W.	Places Names.	Latitude North	Longit. E. or W.
The Coast of England.	D. M.	D. M.		D. M.	D. M.
Berwick ———	55 48	1 45 W	Aberdeen ———	57 10 N	1 45 W
Newcastle ———	55 12	1 30 W	Dundee ———	56 28 N	2 40 W
Stockton ———	54 33	1 25 W	Edinburgh ———	55 58 N	3 12 W
Spurn ———	53 45	0 13 E	The Coast of Ireland.		
Yarmouth ———	52 45	1 45 E	Dublin ———	53 21	6 7
L O N D O N ———	51 32	0 0	Wexford ———	52 20	6 20
North Foreland ———	51 25	1 24 E	Waterford ———	52 9	7 0
Beachy Head ———	50 46	0 25 E	Cork ———	51 54	8 28
Dunnose ———	50 35	1 23	Cape Clear ———	51 18	11 15
Portland ———	50 30	2 35	Limeric ———	52 23	9 35
Start ———	50 9	3 51	Galway ———	53 7	9 40
L I Z A R D ———	49 57	5 14	Slime Head ———	53 20	11 15
Land's-end ———	50 6	6 0	Londonderry ———	55 10	7 50
St. Mary Scilly ———	49 57	6 40	Belfast ———	54 43	6 30
Hartland Point ———	51 6	4 35	The Coast of Holland and Flanders.		
Lundy Island ———	51 15	4 40	Scaw ———	57 30	10 20
Bristol ———	51 33	4 35	Helighland ———	54 24	8 30
St. David's Head ———	51 58	5 22	Hambrough ———	53 41	10 35
Barley Isle ———	52 44	5 0	Embden ———	53 5	7 30
Holy-head ———	53 23	4 50	The Fly ———	53 15	5 30
Liverpool ———	53 20	3 0	The Texel ———	53 15	5 10
Whitehaven ———	54 17	3 30	Amsterdam ———	52 23	4 45
Carlisle ———	54 47	3 5	Rotterdam ———	51 55	4 30
The Coast of Scotland.			The Brill ———	52 0	4 0
Glasgow ———	55 52	4 15	Sluys ———	51 14	3 40
N. Part of Sky Isle ———	53 45	5 45	Calais ———	50 58	1 50
North Part of Lewis Isle } ———	58 20	7 20	The Coast of France and Portugal.		
St. Kilday ———	57 52	9 45	Dieppe ———	49 56 N	1 0 E
Farro Head ———	58 34	5 10	Cape de Hogue ———	49 47	2 0 W
Isles of Orkney ———	59 10	3 22	Caskets ———	49 50	2 20
Shetland S. Point ———	60 4	2 0	Guernsey ———	49 33	2 47 W
Buchanefs ———	57 35	1 33	Paris ———	48 50	4 1 E

A Table of Latitude and Longitude.

Places Names.		Latitude North	Longit. E or W.		Places Names.		Latitude North	Longit. E. or W.
The Coast of France & Portugal.		D M	D M				D. M.	D. M.
Morlaix	48	33	3 54	West Longitude.	Ancona	43	38	13 35
Ushant	48	26	5 7		Venice	45	25	12 10
Brest	48	23	4 31		Lepanto	38	10	22 52
Penmark	47	48	4 24		Cape Marapan	36	33	22 41
Bellisle	47	18	3 11		Cape St. Angelo	36	32	23 56
Nantz	47	14	1 39		Athens	38	5	23 52
Island Dieu	46	34	2 13		Cape Martelo S.	38	7	25 0
Ile of Ree	46	10	1 30		P of Negropont	38	7	25 0
Rachel	46	10	1 16		Cape Monte Sancto	40	26	24 57
Bordeaux	44	50	0 38		Gallipoli	40	33	27 20
Bilboa	43	29	2 58	North Latitude.	Constantinople	41	0	28 56
Cape Ortegal	43	46	7 33		Smyrna	38	28	27 25
Cape Finister	42	51	9 12		Ephefus	38	1	27 53
Oporto	41	10	8 25		Antiochetta	36	30	32 46
Burlings	39	20	9 24		Scanderoon	36	34	36 30
Rock of Lisbon	38	45	9 29		Tripoli	34	38	36 15
Cape St. Vincent	37	2	9 6		Alexandria	31	11	30 19
Cadiz	36	33	6 7		Cape Rufaro	32	48	21 25
Cape Trefalgar	36	10	6 6		Cape Meturato	32	21	16 17
					Tripoly	32	54	13 10
The Coast on the Main Continent within the Straits					Cape Bona	37	3	11 4
					Bona	37	2	8 14
Gibraltar	35	5	5 17	East Longitude.	Algier	36	50	2 7
Cape de Gat	36	40	1 45		Cape de tres forcas	35	30	2 4W
Minorca	39	33	4 25		Tetuan	35	27	5 6W
Cape Paul	38	15	0 2		Ceuta	35	54	4 45W
Cape Martin	38	46	0 35		Tangier	35	42	5 22W
Barcelona	41	26	2 13					
Marseilles	43	18	5 27		Islands within the Straits.			
Toulon	43	7	5 58		Alboran	35	54	2 29W
Genoa	44	25	8 43		Formentaria	38	33	1 55E
Leghorn	43	28	10 35		Yvica	38	50	1 40
Rome	41	54	12 29	North Latitude.	Majorca	39	30	3 3
Naples	40	51	14 19		Port Mahon	39	51	3 59
C. Spartaventuro	37	56	16 55		Gallitta	37	41	8 44
Cape Collone	38	56	18 5		Sardinia South End	38	54	9 12
Gallipoli	39	56	18 40		Corfica North End	42	56	9 50
Cape St. Mary	39	45	19 0					

A Table of Latitude and Longitude.

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Places Names.		Latitude North		Longit. E. or W.		Places Names		Latitude N. or S.		Longit. E. or	
Islands within the Straits.		D.	M.	D.	M.			D.	M.	D.	M.
Gorgona		43	34	9	38	Cape 3 Points		4	28	1	50W
Capria		43	3	10	27	River Volta		5	55	3	25
Lilboa		42	45	11	0	River Formosa		7	0	6	40
Messina		38	7	16	20	Cape Formosa		4	15	6	40
Maritimo		38	12	17	9	New Calabar		4	42	8	33
Cape Passaro		36	38	15	40	Old Calabar		4	10	9	45
Malta		35	53	14	35	River Cameroones		3	25	10	10
Corfu		39	42	20	0	River de Angra		0	50	10	1
Zephalonia		38	15	21	0	Lopas		0	55	9	55
Zante		37	46	21	14	River Congo		5	40	15	25
Morea		36	52	21	32	Angola		8	57	15	56
Lemnos		39	59	25	37	Cape Negro		16	8	12	31
Scio		38	22	26	12	Cape St. Thomas		24	10	14	43
C. St. John West end of Candy		35	15	24	0	C. Bona Esperance		34	29	18	29
Cape Solomon, E end of Candy		35	0	27	8						
Rhodes City		36	27	28	5	Western Islands.					
West end of Cyprus		34	57	32	23	Corvo		39	42	31	30
East end of Cyprus		35	31	35	0	Flores		39	30	31	29
						Fyal		38	32	28	55
						Pico		38	19	28	15
						St. George		38	39	27	55
						Fercera		38	45	27	6
						St. Michael		37	47	25	42
						St. Maries		36	56	25	4
The Coast of Barbary and Guiney.						The Canary Islands.					
Cape Spartel		35	50	5	49	Ferro		27	47	17	45
Sallee		33	51	6	25	Palma		28	37	17	36
Cape Cantin		32	36	9	10	Gomero		28	6	17	5
Cape de Geer		30	37	10	6	Teneriff		28	13	16	28
Cape Bajadore		26	4	15	35	Madeira West end		32	27	17	28
Cape Olerado		23	41	15	50	Porto Sancto		32	58	16	15
Cape Blanco		20	32	17	35	Canaria		27	52	15	38
Senegal		15	28	16	25	Forteventura		28	5	14	26
Cape de Verde		14	45	17	25	Lancerota		29	12	12	45
River Gambia		13	8	15	31						
Sierraleona		8	36	12	57						
Monseurado		6	5	10	2						
Cape Palmas		4	13	6	45						

A Table of Latitude and Longitude.

Places Names.	Latitude N. or S.	Longit. E. or W.	Places Names.	Latitude N. or S.	Longit. East.
Cape de Verde Islands.	D. M.	D. M.		D. M.	D. M.
St. Antonio ———	17 24	25 12	Vifagapatam ———	17 43	83 57
St. Vincent ———	17 14	24 49	Cape Palmiras ———	20 42	87 52
St. Lucia ———	17 2	24 45	Bengal ———	22 17	92 21
St. Nicholas ———	16 54	24 3	Cape Negrais ———	16 23	93 0
Brava ———	14 28	24 2	Malacca ———	2 12	102 10
Fuego ———	14 56	24 25	Siam Entrance ———	14 18	100 55
St. Jago ———	14 54	22 56	Cambodia Entrance	10 28	105 0
Isle of May ———	15 14	23 0	Cochin ———	14 5	107 56
Isle of Sal ———	16 38	22 56	Canton ———	23 8	113 6
Bonavilla ———	16 5	22 42	Amoy or Quemoy	24 35	116 50
			Laimpo ———	29 59	120 35
			Nanquin ———	32 55	120 1
Southern Islands.			Islands in the East-Indies.		
St. Matthew's ———	1 30 S	6 1 W	Madagascar } S. end	25 47	46 10
Ascension ———	7 20 S	13 15 W	Ditto ——— } N. end	12 10	51 5
St. Helena ———	15 56 S	5 41 W	Mayetta ———	13 10	45 38
Fernandepo ———	2 40 N	10 30 E	Mohilla ———	12 5	44 23
Princes ———	1 40 N	9 15 E	Comero ———	11 40	43 50
St. Thomas ———	0 0	8 20 E	St. Juan de Nova —	16 30	42 40
Ananbona ———	2 10 S	7 27 E	Mauritius ———	20 10	57 2
The Coast on the Main Continent in the East-Indies.			Diego Royes ———	19 50	61 30
Cape Lagullas ———	34 54 S	21 20	Romeras de Castela	28 45	67 17
Cape Corientes ———	23 40 S	36 17	Amsterdam [mas	38 40	72 45
Mofambique ———	15 4 S	41 10	St. Brandon ———	16 38	64 30
River de Fuegos —	0 14 S	41 15	Diego Gratiosa ———	8 40	68 25
Cape Bassos ———	4 6	47 38	Quabella ———	3 53	52 36
Cape Guardefoy —	11 44	51 20	Bassas de Chagos —	6 55	68 45
Cape Rosulgat ———	22 41	59 45	Yas de Diego Rey	0 20	72 0
C. Muca ———	23 32	59 45	Maldivia } N. end	7 14	73 4
Bufero ———	29 45	49 20	Maldivia } S. ends	0 25	76 22
Burat ———	21 10	72 25	Malique ———	9 0	72 58
Goa ———	15 31	73 50	Sacatra ———	12 21	54 5
Gallecor ———	11 16	75 30	Abdeleur ———	12 4	53 4
Cochin ———	9 54	75 55			
Cape Comarin ———	7 56	77 25			
Fort St. George —	13 4	80 32			
Dew Point ———	16 8	81 32			

A Table of Latitude and Longitude.

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Places Names.	Latitude N. or S		Longit. E. or W	Places Names	Latitude N or S		Longit. East.
Islands in the East-Indies.	D.	M.	D. M.	The Coast of America in the S. Sea.	D.	M.	D. M.
C. Galloin Zeylone	6	7	81 15	Cape St. Sebastian	42	45	127 55
Yas de Amber	0	0	52 30	Cape St. Lucia	23	20	111 46
Audaman	12	10	93 32	Cape Corientes	19	40	109 30
Nicobar	7	11	93 40	Aquapulco	17	5	104 18
Sumatra NW. End	5	22	94 50	Aquapulco	15	27	102 3
Verkin's Island	2	22	94 7	Guatemala	14	25	101 0
Nassau Island	2	54	99 32	Panama	8	50	81 52
Bencola	3	49	102 8	Bay Bonaventuro	3	24	78 6
Sumatra S E. End	5	22	105 10	Island Gallopega	0	0	90 10
Engano	5	50	101 43	Cape del Ajuga	0	30	84 56
Selan	8	20	102 13	Lima	12	1	76 42
Princes Island	6	30	104 2	Arica	18	29	73 10
Bantam in Java	6	11	105 55	I. La Serena	29	0	76 22
Ratavia	6	9	106 46	I. Juan Fernandes	33	15	83 18
Java E. A End	8	32	113 30	Baldivia	39	35	81 10
Straits of Sundry	6	2	105 46	Port Steven	46	50	82 36
Banca South End	3	20	106 45	Cape Victory	52	22	76 42
Borneo South Point	3	54	113 37	Cape Horn	55	58	67 21
Banda Isles	4	55	127 17				
Celebes { South End	5	10	119 7				
{ N. End	1	40	121 20				
Mindano West point	6	40	119 15				
Borneo North Point	7	10	113 5				
Luconia { SW. poi	12	30	120 10				
{ NE. poi	18	35	120 5				
Anian { NW point	19	30	107 0				
{ NE. point	19	55	109 55				
Formosa { S point	22	0	119 56				
{ N. point	25	30	120 45				
Piscadore Isles	23	30	118 35				
Island Chusan	30	38	120 35				
Japan { S.E. point	35	30	140 30				
{ S.W point	35	0	128 30				
Manilla	14	36	120 56				
Bombay	18	57	72 38				
Timor { SW Point	10	23 S	124 4				
{ S. Point	8	15 S	132 0				

A Table of Latitude and Longitude.

Places Names.	Latitude North	Longit. West.	Places Names.	Latitude North	Longit. West
The Coast of Brazil, &c.	D. M.	D. M.		D. M.	D. M.
Cape St. Augustine	8 35 S	35 20 W	St. Bartholomew	17 52	62 6
Cape Roque	5 0 S	35 47 W	St. Martin's	18 6	62 10
Tristian D'Acunha	37 5 S	13 24 W	Anguilla	18 17	62 13
Trinidad	20 30 S	30 0 W	Virgin's	18 30	63 25
Main Continent in the West-Indies.			St. Cruize	17 52	63 30
			Bieque	18 0	63 15
			Porto Rico St John's	18 30	65 37
			St. Domingo Hispan	18 25	69 30
			P. Royal Jamaica	18 0	76 32
			East End of Cuba	20 15	73 55
			Havanna	22 40	82 55
			Bay Hondy	22 45	83 40
			Cape St. Antonio	21 45	85 32
			Bahama Islands.		
R Amazonas Entr.	0 0	49 56	Bermudas	32 35	63 40
North Cape	2 5	49 56	North Point	27 56	78 35
Surinam	6 25	56 50	of Bahama Bank	26 50	79 26
Oronoque	8 15	59 25	Bahama Island	26 0	73 46
C. Conquibaca	12 40	70 42	Abaco S. Point	25 37	76 47
Carthagenia	10 28	75 21	Harbour Island	25 10	78 50
Scot's Settlement	8 30	78 45	Andros N. Point	25 0	77 20
Nicaragua Entrance	11 25	84 15	Providence	24 40	75 56
Cape Carocha	21 10	86 10	Eleuthera S. point	24 25	75 9
Campechy	19 30	92 10	Cat Island	24 3	74 35
La Vera Cruz	19 12	97 48	Watling's Island	23 45	74 50
Escondido	30 20	89 30	Rum Key	23 22	75 55
Cape Florida	24 57	90 30	Exuma	22 56	74 12
The Caribbee Islands.			Crooked Isle N. point	22 17	74 5
			Atkin's Key	21 58	74 45
			Meraparovouz	23 10	73 35
			Atwood Keys	22 40	73 40
			French Keys	22 35	72 46
			Mayaguana	21 17	73 55
			Hogfies		
Trinidad	10 15	60 17			
Tobago W. End	11 10	59 10			
Granado	11 57	60 20			
Barbadoes	22 58	58 50			
St. Vincent	13 12	60 12			
St. Lucia	13 55	60 4			
Martinico	14 43	60 54			
Dominico	15 18	61 30			
Marigallante	15 58	60 20			
Guardalupa	16 10	61 54			
Monserat	16 45	62 15			
Antegua	17 5	62 4			
Nevis	17 5	62 32			
St. Christopher's	17 17	62 40			
Barbuda	17 56	61 40			

A Table of Latitude and Longitude.

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Places Names	Latitude North		Longit. West		Places Names.	Latitude North		Longit. E. or W	
Bahama Islands.	D. M.		D. M.		The Coast Hudson's Bay and Straits.	D. M.		D. M.	
Hyneago W. End —	20	52	73	46	Buttons Isles —	66	25	66	27
Caicos Bank —	}	50	71	15	Cape Charles —	62	10	75	35
N. point —					Cape Walsingham —	62	35	77	55
Turk's Island —					Mansfield Isle —	61	42	80	30
Abrolho N. point —	21	35	70	88	Cape Jones —	54	55	78	58
Platewrack —	20	10	68	15	Rupert's River —	51	30	79	26
The Coast of Carolina, Virginia, Maryland, Pennsylvania, New-England, and New-foundland					Albany River —	52	26	84	50
					The Cubb's —	54	10	82	40
					C. Henrietta Maria —	55	7	84	30
					Port Nelson —	57	10	93	58
					Cape Churchill —	59	0	95	20
					C. Southampton —	61	55	86	48
					Shark Point —	64	30	82	55
					Nottingham Isle —	63	30	79	53
					Q. Ann's Foreland —	63	48	74	45
					Resolution Isle —	61	50	65	04
Charles Town —	}	45	78	46	Cape Farewell —	59	45	46	45
upon Ashly River —					The Coast of Iceland, Greenland, Nova Zembla, and the Northern Isles.				
Cape Hatteras —	35	15	74	20					
Cape Henry —	37	0	75	24					
Cape Charles —	37	16	74	16					
Cape Hinlopen —	38	50	74	56					
Long Island —	40	50	72	45					
New York —	40	58	73	53					
Cape Cod —	42	12	68	55					
Boston —	42	30	69	53					
Cape Sable —	43	50	64	58	Sound Royal —	66	22	14	33
Island Sable —	44	20	59	1	Bargazer's Point —	66	20	16	35
Cape Britain —	46	0	58	30	Whales Back —	65	27	20	33
Quebeck —	46	55	69	48	Merchants Foreland —	63	25	17	5
Bay of Brest —	52	10	56	57	Halliford —	64	30	34	43
Bell Island —	52	7	55	35	Fair Foreland —	66	20	26	27
Cape St. John —	50	15	52	48	Grim's Island —	67	15	22	34
Cape Bonavista —	49	15	52	12	Westmania Isles —	63	30	22	24
Trinity Bay Entr. —	48	42	52	20	Isles of Fero —	62	6	5	0
Conception Bay En —	48	20	52	8	Beerenberg, or —	}	45	4	30
St. John's Harbour —	47	32	52	39	John Main's Isle —				
Bay of Bulls —	47	50	51	29	Point Lookout —	76	25	15	36
Cape Race —	46	40	51	52	Horn Sound —	76	45	13	36
Cape St. Mary —	47	10	53	23	Fair Foreland —	79	20	10	52
Placentia Bay —	47	45	53	58	Hacluit's Foreland —	79	55	11	00
Cape Roy —	48	0	57	40	Helie's Sound —	78	55	21	50

Places Names.	Latitude North.		Longit. East.		Places Names.	Latitude North.		Longit. East.	
The Coast of Ice-land, Greenland, Nova, Zemb'a, & Northern Islands.	D.	M.	D.	M.		D.	M.	D.	M.
Lee's Foreland —	78	5	23	25	Gottenburgh —	57	50	12	15
Whale's Head —	77	18	21	30	Elfenore —	56	22	12	42
Hope Island —	76	18	23	45	Copenhagen —	55	41	12	50
Cherry or Bear Isle	74	30	18	08	Valsterborn —	55	28	13	00
Admiralty Island —	75	5	54	50	Calmer —	56	40	16	35
Fretum Borough —	70	0	61	20	Stockholm —	59	20	19	30
Cape Candemose —	69	5	42	35	Wybourgh —	60	52	29	16
Catnose —	65	43	35	14	Petersburg —	59	56	30	25
Archangel Bar —	64	30	39	0	Narva —	59	27	28	25
Cross Island —	66	31	36	33	Revel —	59	27	24	51
Sweetnose —	68	10	34	45	Riga —	57	4	25	15
Kilduyn —	69	30	31	20	Derwinda —	57	15	22	6
North Cape —	71	10	25	52	Coningsburg —	54	43	21	35
Surroy Isle —	71	5	16	40	Dantzic —	54	22	18	36
Tromsund —	70	25	15	30	Wisby in Gotland —	57	30	18	30
Loefort SW. Point	68	15	9	0	Bornholm —	55	15	14	45
Dronten —	63	40	10	15	Straeltund —	54	25	13	16
Stadland —	62	10	4	38	Lubec —	54	6	9	55
North bergen —	60	10	5	40	Anout, or Anholt —	56	50	11	16
Naze of Norway —	57	45	7	24	Lefou, or Lefnou —	57	5	10	30
					Scaw —	57	30	10	20

The Coast in the Sound and Baltic.

Marden —	58	19N	8	57 E
Larwic —	58	54N	9	20 E
Christiana —	59	20N	10	0 E
Maesterland —	57	53N	11	45 E

The Latitudes of any two Places being given to find the Difference of Latitude between them.

Rule, if the Latitudes are both North, or both South, subtract the Less from the Greater, the Remainder will be the Difference of Latitude.

• *Problems of Plane Sailing, wrought by Logarithms, and by Gunter's-Scale.*

P R O B L E M I.

THE Course and Distance being given; to find the Difference of Latitude and Departure.

Example. Suppose a Ship sails South West by South 382 Minutes, and the Difference of Latitude and Departure are required.



In the Right-angled Triangle ABC.

AC represents the Distance sailed.

AB the Difference of Latitude.

BC the Departure.

BAC (or the Angle at A) the Angle of the Course.

ACB (or the Angle at C) the Complement of the Course to 90 deg.

Characters used in Navigation and Astronomy.

S. stands for Sine.

T. for Tangent.

S.c. Sine Complement. T.c. Tangent Complement.

The given Sides and Angles of a Triangle are marked with a dash (").

The required Sides and Angles with a Cypher thus (°.)

The Operation by Logarithms. For the Difference of Latitude.

As Radius	_____	_____	_____	_____	10.000000
To the Distance sailed 382 Minutes	_____	_____	_____	_____	2.582063
So is the S.c. of the Course 56d. 15m.	_____	_____	_____	_____	9.919846
To the Difference of Latitude 317.6 Minutes	_____	_____	_____	_____	12.501909

For the Departure.

As Radius	_____	_____	_____	_____	10.000000
To the Distance sailed 382 Minutes	_____	_____	_____	_____	2.582063
So is the S. of the Course 33d. 45m.	_____	_____	_____	_____	9.744739
To the Departure 212.2 Minutes	_____	_____	_____	_____	12.326802

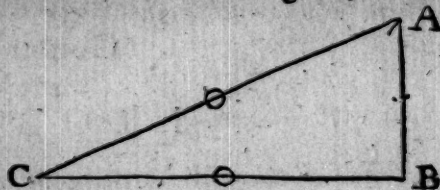
The Operation by Gunter's Scale.

One Foot of the Compasses being in the Radius, or S. of 8 Points; extend the other to the Distance 382 Minutes, the said Extent laid from S. Course 3 Points will reach to 212.2 Minutes, the Departure from the Meridian, and the Compasses kept at the same Distance will reach from the S.e. Course 5 Points to 317.6 Minutes, the Difference of Latitude as above.

PROB.

PROB. II. The Course and Difference of Latitude given, to find the Distance and Departure.

Suppose a Ship sails WSW until the Difference of Latitude be 219 Leagues, and the Distance and Departure required.



The Operation by Logarithms. For the Distance.

As the S.e. of the Course 22d. 30m.	_____	9.82840
To the Difference of Latitude 219 Leagues	_____	2.340444
So is Radius	_____	10.000000
To the Distance, which is 572.2 Leagues	_____	2.757604

For the Departure.

As Radius	_____	10.000000
To the Distance 572.2 Leagues found before	_____	2.757548
So is the Sine of the Course 67 deg. 30 min.	_____	9.965615
To the Departure 528.6 Leagues	_____	12.723163

By Gunter.

The Compasses being extended from the S. of 2 Points, the Complement of the Course to 219 Leagues, the Difference of Latitude, will reach from Radius S. 8 Points, to 572.2 Leagues, the Distance, and the same Extent of the Compasses from the Sine of the Course 6 Points, will reach to 528.6 Leagues, the Departure.

PROB. III. The Course and Departure given, to find the Distance and Difference of Latitude.



Suppose a Ship sails North East by East, and her Departure be 220 Minutes, the Distance and Difference of Latitude required.

By Logarithms. For the Distance.

As the S. of the Course 56 deg. 15 min.	_____	9.919846
To the Departure 220 Minutes	_____	2.342423
So is Radius	_____	10.000000
To the Distance 264.6 Minutes	_____	2.422577

For the Difference of Latitude.

As Radius	_____	10.000000
To the Distance 264.6 Minutes	_____	2.422590
So is the S.c. of the Course 33 deg. 45 min.	_____	9.744739
To the Difference of Latitude 147 Minutes	_____	12.167329

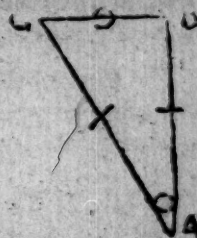
By Gunter.

The Extent of the Compasses from the S. of the Course 5 Points to the Departure 220 Minutes, will reach from Radius S. of 8 Points,

to 264.6 the Distance; and the same Extent of the Compasses from S. 3 Points the Complement of the Course, will reach to the Difference of Latitude 147 Minutes, as above.

P R O B. IV. The Distance and Difference of Latitude given, to find the Course and Departure.

Suppose a Ship sails between the North and the West 206 Miles, until the Difference of Latitude be 197 Miles, the Course and Departure required.



By Logarithms. For the Course.

As the Distance 206 Miles	_____	_____	_____	_____	2.313867
To the Radius	_____	_____	_____	_____	10.000000
So is the Difference of Latitude 197 Miles	_____	_____	_____	_____	2.294466
To the S.c. of the Course; which is N. 17d. 00m. West.	_____	_____	_____	_____	9.980599

For the Departure.

As the Radius	_____	_____	_____	_____	10.000000
To the Distance 206 Miles	_____	_____	_____	_____	2.313867
So is the S. of the Course 17 deg. 00 min.	_____	_____	_____	_____	9.465935
To the Departure 60.23 Miles	_____	_____	_____	_____	11.779802

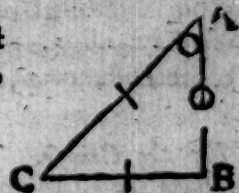
By Gunter.

For the Course. The Extent from the Distance 206 Miles, to the Difference of Latitude 197 Miles, will reach from Radius S. 90 deg. to the Sine of 73 deg. 00 min. the Complement of the Course, which subtracted from 90d. is 17d. 00m. the Course N. Westerly, or N. by W. half W.

For the Departure. The Extent from Radius S. 90d. to the Sine of the Course 17 deg. 00 min. will reach from the Distance 206 Miles, to the Departure 60.23 Minutes, as above.

P R O B. V. The Distance and Departure given, to find the Course and Difference of Latitude.

Suppose a Ship sails between the South and the West 247 Minutes, until the Departure be 197 Minutes, required the Course and Difference of Latitude.



The Operation by Logarithms. For the Course.

As

As the Distance 247 Minutes	_____	_____	_____	_____	2.392697
To the Radius	_____	_____	_____	_____	10.000000
So is the Departure 197 Minutes	_____	_____	_____	_____	2.294466
To the Sine of the Course S. 52 deg. 54 min. Westerly	_____	_____	_____	_____	9.901769

Plane Sailing.

For the Difference of Latitude.

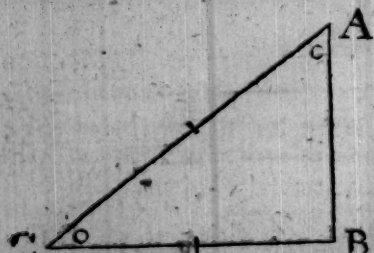
As Radius	_____	_____	_____	_____	10.000000
To the Distance 247 Minutes	_____	_____	_____	_____	2.392697
So is the S.c. of the Course 37 deg. 6 min.	_____	_____	_____	_____	9.780467
To the Difference of Latitude 149 min.	_____	_____	_____	_____	12.173164

By Gunter.

For the Course. The Extent of the Compasses from the Distance 247 Minutes, to the Departure 197 Minutes, will reach the same way from Radius S. 90 deg. to the Sine of the Course 52 deg. 54 min. South Westerly, or South West three quarters West.

For the Difference of Latitude. The Extent from Radius S. 90 deg. to S. 37 deg. 6 min. the Complement of the Course, will reach the same way from the Distance 247 min. to the Difference of Latitude 149 min.

PROB. VI. The Difference of Latitude and Departure given, to find the Course and Distance.



Suppose a Ship sails between the South and the West, until the Difference of Latitude be 154 Leagues, and her Departure 200 Leagues; required the Course and Distance.

B The Operation by Logarithms. For the Course.

As the Difference of Latitude 154 Leagues	_____	_____	_____	_____	2.187521
To Radius	_____	_____	_____	_____	10.000000
So is the Departure 200 Leagues	_____	_____	_____	_____	2.301030
To the Tangent of the Course 52d. 24m. South W.erly	_____	_____	_____	_____	10.113509

For the Distance.

As the S.c. of the Course 37 deg. 36 min.	_____	_____	_____	_____	9.785433
To the Difference of Latitude 154 Leagues	_____	_____	_____	_____	2.187521
So is the Radius	_____	_____	_____	_____	10.000000
To the Distance 252.5 Leagues	_____	_____	_____	_____	2.402088

By Gunter.

For the Course. The Extent of the Compasses from the Difference of Latitude 154 Leagues, to the Departure 200 Leagues, will reach from Radius or Tangent of 45 deg. to the Tangent of the Course, 52 deg. 24 min. South Westerly, or South West three quarters West.

For the Distance. The Extent from the S. 37 deg. 36 min. the Complement of the Course, to Radius, or the Sine of 90 deg. will reach from the Difference of Latitude 154 Leagues, to the Distance 252.5 Leagues.

Oblique Plane Sailing.

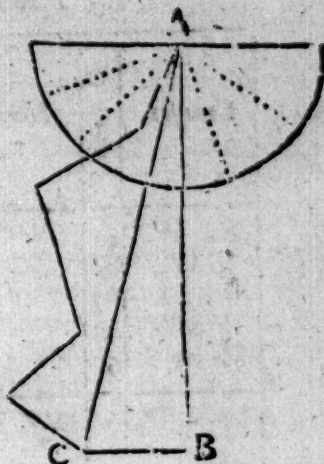
PROB. VII.

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This Problem shews the manner of working a Traverse; and is very useful in keeping a Reckoning by Plane Sailing.

Example.

Suppose a Ship bound to a certain Port, and sails first SSW. 40 minutes, then SW. 60 min. then S. by E. 63 min. then WSW. 49 min. then S. E. by S. 56 min. the Difference of Latitude and Departure the Ship hath made, with the direct Course and Distance is required.



The Operation by Logarithms.

For the Difference of Latitude for the first Course.

As Radius	_____	10.000000
To the Distance 40 min.	_____	1.602060
So is the S.c. of the Course 67d. 30m.	_____	9.905615
To the Difference of Latitude 36.95 min.	_____	11.567675

For the Departure of the first Course.

As Radius	_____	10.000000
To the Distance 40 min.	_____	1.602060
So is the S. of the Course 22d. 30m.	_____	9.582840
To the Departure 15.31 min.	_____	11.184900

By Gunter.

The Extent of the Compasses from Radius the S. of 8 Points, to the Distance 40 min. that Extent in the Compasses laid from the Sine of the Course 2 Points, will reach to 15.3 min. the Departure, and the Compasses being kept to the same Extent, and laid from the S. 6 Points, the Complement of the Course, will reach to 36.9 min. the Difference of Latitude.

In the same manner proceed to find the Difference of Latitude and Departure for each Course and Distance; which being found, place in a Table as follows.

L

the

Plane Sailing.
The TRAVERSE-TABLE.

<i>Courses.</i>	<i>Distance.</i>	<i>North.</i>	<i>South.</i>	<i>East.</i>	<i>West.</i>
S S W.	40		37.0		15.3
SW.	60		42.4		42.4
S by E.	63		61.8	12.3	
W S W.	49		18.8		45.3
SE by S.	56		46.6	31.1	
		<i>Diff. Lat.</i>	206.6	43.4	103.0
				<i>Dep.</i>	43.4
					59.6

The Explanation of the TABLE.

In placing the Difference of Latitude and Departure in their proper Columns, observe, that if the Course be Northerly, the Difference of Latitude is put in the North Column; if it be Southerly, in the South Column; and if the Course be Easterly, the Departure is put in the East Column; if Westerly, in the West Column.

Thus having framed the Table, add up the North, South, East, and West Columns severally, whereby the Difference of Latitude appears to be 206.6 Minutes South, because there is nothing in the North Column; The Departure 59.6 Minutes West, because by so much the West Column exceeds the East; then by this Difference of Latitude and Departure, find the direct Course and Distance as follows.

The Operation by the Logarithms. For the direct Course.

As the Difference of Latitude 206.6 min. 2.315130
 To the Radius 10.000000
 So is the Departure 59.6 min. 1.77524
 To the T. of the Course 16d. 5m. South Westerly, because }
 the South and West Columns exceeds the North and East } 9.460116

For the Distance.

As the S.c. of the Course 16d. 5m. 9.982660
 To the Difference of Latitude 206.6 min. 2.3156130
 So is Radius 10.000000
 To the Distance required 215 min. 2.332470

By Gunter. For the direct Course.

The Extent of the Compasses from the Difference of Latitude 206.6m. to the Departure 59.6m. will reach from the Tangent of 45d. (or Radius) to the Tangent of 16d. 5m. the Course required.

For the Distance.

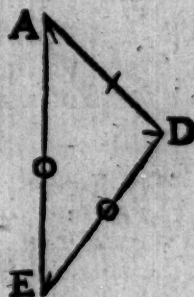
The Extent from S. 73 deg. 55 min. the Complement of the Course to S. 90 deg. viz. Radius will reach from the Difference of Latitude 206.6m. to the Distance 215 Minutes.

Oblique-angled Plane Triangles, applied in PROBLEMS of Plane - Sailing, and wrought by Logarithms, and Gunter's-Scale.

PROB. I. THE Angles and one of the Sides given, to find either of the other Sides.

Example.

Suppose there are two Ports both under one Meridian, a Ship sails from the Northernmost SE. 206 Miles, another Ship sails from the Southernmost North East by North, a certain Number of Miles, and meets with the first Ship; the Distance between these two Ports, and the Distance sailed by the second Ship is required.



In the Triangle ADE.

A and E represents the two Ports. AD the first Ship's Distance. ED the second Ship's Distance. AE the Distance between the two Ports.

The Operation by Logarithms. For the Distance between the two Ports.

As S. AED 33d. 45m.	_____	Co. Ar.	0.255261
To AD the first Ship's Distance 206 min.	_____		2.313867
So is S. ADE 101d. 15m. which subtracted from 180d.	_____		9.991574
To AE, the Distance between the two Ports 363.7m.	_____		12.560702

In all Proportions where Radius is not one of the three given Terms to save the Labour of subtracting the first Logarithm from the Sum of the second and third, use the Complement Arithmetical of the first Logarithm

rum, which is found by subtracting each Figure of the Logarithm from 9, except the first towards the Right-hand, which is subtracted from 10, as in the Operation, the Logarithmic Sine found in the Table is 9.744739, wherefore beginning at the Left-hand, say 9 from 9 there remains 0; 7 from 9 there remains 2; 4 from 9 there remains 5; 4 from 9 there remains 5; 7 from 9 there remains 2; 3 from 9 there remains 6; 9 from 10 there remains 1; So the Complement Arithmetical of the first Logarithm, is 0.255261, which added to the other two Logarithms, and from that Sum abate the Radius, the Remainder is the Logarithmic Sine, or Tangent required.

And Note, to find the Sine of any Degree and Minute above 90d. subtract the Degree and Minute from 180d. the Sine of the Remainder (called the Supplement) is the Sine required.

For the Second Ship's Distance.

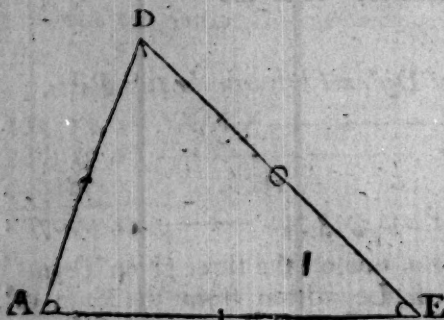
As S. AED. 33d. 45m. —————	Co. Ar.	0.255261
To AD the first Ship's Distance 206 min. —————		2.313867
So is S. DAE 45d. 0m. —————		9.849485
To DE the second Ship's Distance, 262.2 min. —————		12.418613

By Gunter. For the Distance between the two Ports.

The Extent of the Compasses from S. of 33 deg. 45 min. to the S. ADE 78d. 45m. (viz. the Supplement of 101d. 15m. to 180d) will reach from 206 min. the first Ship's Distance, to 363.7 min. the Distance between the two Ports, as above.

For the second Ship's Distance.

The Extent of the Compasses from the S. of 33d. 45m. to the S. of 45d. 0m. will reach from 206 min. the first Ship's Distance, to 262.2 min. the second Ship's Distance required.



P R O B. II

Two Sides and an Angle opposite to one of them being given, to find the other opposite Angle and the third Side.

Example.

Suppose two Ports, whose Bearing is North East and South West, distant 396 Miles, a Ship at the northernmost sails South South East, and another Ship at the southernmost sails thence 518 Miles, and meets with the first Ship: The Course sailed by the second Ship, and the first Ship's Distance are required, In

Oblique Plane Sailing.

85

In the Triangle A D E.

A represents the Southermost Port, D the Northermost.

AD the Distance between the two Ports.

DE the Course and Distance sailed by the first Ship.

AE the Course and Distance sailed by the second Ship.

The Operation by Logarithms. For the second Ship's Course.

As AE the second Ship's Distance 518 min. ———	Co. Ar. 7.285671
To S. ADE 67d. 30m. ———	9.965615
So is AD the Distance between the two Ports 396 min. ———	2.597695
To S AED 44 deg. 56 min. ———	19.848981

The Angle at D 67d. 30m. and the Angle at E 44d. 56m. being added together and subtracted from 180d. gives 67d. 34m. the Angle at A, which makes nearest 6 Points, and 6 Points reckon'd from the North East to the Southward gives ESE. the second Ship's Course required.

For the first Ship's Distance.

As S. ADE 67d. 30m. ———	Co. Ar. 0.034385
To AE the second Ship's Distance 518m. ———	2.714330
So is S. DAE 67 deg. 34 min. ———	9.965824
To DE the first Ship's Distance 518.3 min. ———	12.714539

By Gunter. For the second Ship's Course.

The Extent of the Compasses from 518 min. to S. 67d. 30m. will reach from 396 min. to S. 44 deg. 56 min. which added to the Angle at D, and the Sum subtracted from 180d. gives 67d. 34m. the Angle at A, as above.

For the first Ship's Distance. The Extent from S. 67d. 30m. to 518m. will reach from S. 67d. 34m. to 518.3 m. the Ship's Distance, as above.

P R O B. III.

Two Sides and the contained Angle given, to find the other Angles and Side.

Example.

Suppose two Ships sail from one Port; one sails N E: 140 Miles, the other South East by East 115 Miles, the Bearing and Distance of these two Ships is required.

Let D represent the Port, DA the first Ship's distance, and DE the second.

Miles
140
115
255
Diff. 25



The Operation by Logarithms. For the Bearing of the two Ships.

As the Sum of the Sides AD and DE 255 min. — Co. Ar. 7.593460
 To the Difference of the said Sides 25 min. — 1.397940
 So is the T. of half the Sum of their opposite Angles 50d. 37m. 10.085698
 To the T. of half their Difference, which is 6d. 48m. — 19.077098

The half Difference added to the half Sum, gives 57d. 25m. the greater Angle AED. The half Difference subtracted from it gives 43d. 49m. the lesser Angle DAE. Wherefore the Bearing of the two Ships is N. Easterly, and South Westerly 1d. 11m.

For the Distance of the two Ships.

As S. AED 57d. 25m. — Co. Ar. 0.074374
 To AD the first Ship's Distance 140 min. — 2.146128
 So is S. ADE 78d. 45m. — 9.991574
 To AE the Distance of the Ships, 163 min. — 12.212076

By Gunter. For the Bearing of the two Ships.

The Extent of the Compasses from the Sum of the Sides 255m. to their Difference 25m. will reach from the T. of the Half Sum of the required Angles 50d. 37m. to the T. of half the Diff. of the said Angle 6d. 48m.

In this Proportion by *Gunter*, the Practitioner may be at a Loss, because the Point T. 50d. 37m. would fall beyond the T. of 45d. was the Tangent Line continued: To remedy which, place the Extent from 255 to 25, from the T. 45d. and it will reach to the T. of 5d. 37m. then letting one Point stand at 5d. 37m. extend the other to the T. of 50d. 37m. this Extent place from the T. of 45d. will fall on the T. 6d. 48m. required.

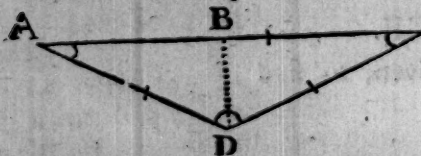
For the Distance of the Ships.

The Extent from the Sine of 57d. 25m. to the Sine of 78d. 45m. will reach from 140m. to 163m.

P R O B. IV. Three Sides being given, to find the Angles.

Example. Suppose there are two Ports both in one Latitude, distant 536 Miles; a Ship sails from the Eastward 306 Miles between the South and the West; another Ship sails from the Westermost 290 Miles, and meets with the first Ship. The Course that each Ship hath steered is required.

Let A and E represent the two Ports, D the Place where the Ships meet.



This Question is resolv'd by letting fall a Perpendicular DB, reducing the Oblique Triangle ADE, into the two Right-angled Triangles ABD and EBD, then the Operation is as follows;

First, find the greater Segment to the Base BE, thus,

As the Base AE, 536 Miles — Co. Ar. 7.270835
 To the Sum of the Sides AD and ED 596 Miles — 2.775246
 So is the Difference of the said Sides 16 Miles — 1.204120
 To the Diff. of the Segments of the Base, which is 17.8 Miles 11.250201

The

The whole Base ————— 536 min.
 The Difference of the Segment is ——— 17.8
 Sum is ————— 553.8
 Half Sum ————— 276.9 the greater Segment BE.

Then say, *For the first Ship's Course.*

As DE the first Ship's Distance 306 min. ————— 2.485721
 To Radius ————— 10.000000
 So is the greater Segment BE 276.9 min. ————— 2.442323
 To S.c. BED, 25d. 9m. ————— 9.956602

The Angle at E is the Course from the West Southerly, so the first Ship steers South 64d. 51m. West, or SW. by W. three quarters West almost.

For the second Ship's Course.

As AD the second Ship's Distance 290 min. ————— Co. Ar. 7.537602
 To Sine AED 25d. 9m. ————— 9.628378
 So is DE the first Ship's Distance 306 ————— 2.485721
 To Sine DAE 26d. 39m. ————— 19.651701

The Angle at A is the Course from the East Southerly, so the second Ship steers South 63d. 21m. East, or SE. by E. 3 quarters E. nearly.

By Gunter. For the Difference of the Segments of the Base.

The Extent of the Compasses from the Base AE 536 min. to the Sum of the Sides 596m. will reach from the Difference of the Sides 16, to the Difference of the Segments of the Base 17.8, with which proceed as before.

For the first Ship's Course.

The Extent from the Distance 306 min. to the greater Segment 276.9 min. will reach from Radius or Sine 90d. to Sine 64d. 51m. the Complement BED 25d. 9m. required.

For the second Ship's Course.

The Extent from 290m. the second Ship's Distance, to 306min. the first Ship's Distance, will reach from the Sine 25d. 9m. to the Sine 26d. 39m. the Angle at A required.

P R O B. V.

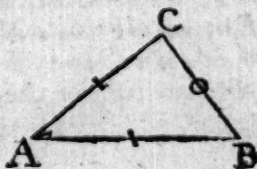
Two Sides and their contained Angle given, to find the third Side.

Example.

Two Ships sails from one Port at A; the first sails East 335 Miles to B, the second sails East 14d. 40m. North, 271 Miles to C; I demand how far they are asunder, and what is the Course from the Ship at C, to that at B?

In the Triangle ABC,
 there is given.

B 335
 C 271
 AC 14d. 40m. } BC required.



This

This Case requires a double Operation.

By the third Case to find the Angles.

By the first Case to find the Side required.

AB	339
AC	271
Sum is	606
Diff. is	64

The first Operation.

As the Sum of the Sides AB and AC 606 Miles	Co. Ar.	7.217527
To their Difference 64		1.806180
So is the T. of half Sum of the Angles 82d. 40m.		10.890441
To T. half their Difference 39d. 22m.		19.914148
By which you will find the Angle ABC, to be 43d. 18m.		

The second Operation.

As S. ABC 43d. 18m.	Co. Ar.	0.163791
To the Side AC 271 Miles		2.432969
So is S. BAC 14d. 40m.		9.407455
To the Side BC 100 Miles		12.000215

The Angle at B is found to be 43d. 18m. and the Line AB lying East and West, the Course from C to B is East 43d. 18m. South, or South East 1d. 42m. Easterly; and the Distance 100 Miles.

By Gunter. For the Angle at B.

The Extent from 606 Miles the Sum of the Sides, to 64 Miles the Difference of the Sides, will reach from the Tangent of 82d. 40m. half the Sum of the unknown Angles; to the Tangent of 39d. 22m. half their Difference, which being found, proceed according to former Directions, to find the Angle at B.

Then the Extent from S. 43d. 18m. the Angle at B, to S. 14d. 40m. the Angle at A; will reach from 271 Miles the Side AC, to 100 Miles, the Side BC, as above

Thus much for sailing by the *Plane Chart*; which being of some Use in short Voyages, and a good Foundation for further Improvement, we were not willing wholly to omit; but nevertheless would advise all that take Charge of Ships never to content themselves with the Use of the *Plane Chart* only; being so apparently false in itself, and so unsafe for Practice: Nor are we under any Necessity to trust to it, the Defect thereof being now sufficiently supplied by Mr. *Wright's* True Chart, commonly called *Mercator's*, the Projection and Use of which (both in single Questions and Traverses) are largely treated of, and rendered as easy as the *Plane Chart*, in *Atkinson's Epitome*, *Wilson's Navigation*, and now Corrected and Reprinted for J. MOUNT, and T. PAGE, on *Tower-Hill*, with many useful Additions, particularly the Lunar Method of determining the Longitude at Sea.

A LARGE AND USEFUL
T A B L E
O F
Difference of Latitude and Departure,
I N
MINUTES and TENTH PARTS,
T O E V E R Y
DEGREE and QUARTER POINT
O F T H E
C O M P A S S,
For the exact working of a
T R A V E R S E.

L O N D O N:

Printed for MOUNT and PAGE, on
TOWER-HILL.

Diff.	1 Deg.		2 Deg.		$\frac{1}{4}$ Point		3 Deg.		4 Deg.		5 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	01.0	00.0	01.0	00.0	01.0	00.0	01.0	00.1	01.0	00.1	01.0	00.1	1
2	02.0	00.0	02.0	00.1	02.0	00.1	02.0	00.1	02.0	00.1	02.0	00.2	2
3	03.0	00.1	03.0	00.1	03.0	00.1	03.0	00.2	03.0	00.2	03.0	00.3	3
4	04.0	00.1	04.0	00.1	04.0	00.2	04.0	00.2	04.0	00.3	04.0	00.3	4
5	05.0	00.1	05.0	00.2	05.0	00.2	05.0	00.3	05.0	00.3	05.0	00.4	5
6	06.0	00.1	06.0	00.2	06.0	00.3	06.0	00.3	06.0	00.4	06.0	00.5	6
7	07.0	00.1	07.0	00.2	07.0	00.3	07.0	00.4	07.0	00.5	07.0	00.6	7
8	08.0	00.1	08.0	00.3	08.0	00.4	08.0	00.4	08.0	00.6	08.0	00.7	8
9	09.0	00.2	09.0	00.3	09.0	00.4	09.0	00.5	09.0	00.6	09.0	00.8	9
10	10.0	00.2	10.0	00.4	10.0	00.5	10.0	00.5	10.0	00.7	10.0	00.9	10
11	11.0	00.2	11.0	00.4	11.0	00.5	11.0	00.6	11.0	00.8	11.0	01.0	11
12	12.0	00.2	12.0	00.4	12.0	00.6	12.0	00.6	12.0	00.8	12.0	01.0	12
13	13.0	00.2	13.0	00.5	13.0	00.6	13.0	00.7	13.0	00.9	12.9	01.1	13
14	14.0	00.2	14.0	00.5	14.0	00.7	14.0	00.7	14.0	01.0	13.9	01.2	14
15	15.0	00.3	15.0	00.5	15.0	00.7	15.0	00.8	15.0	01.0	14.9	01.3	15
16	16.0	00.3	16.0	00.6	16.0	00.8	16.0	00.8	16.0	01.1	15.9	01.4	16
17	17.0	00.3	17.0	00.6	17.0	00.8	17.0	00.9	17.0	01.2	16.9	01.5	17
18	18.0	00.3	18.0	00.6	18.0	00.9	18.0	00.9	18.0	01.3	17.9	01.6	18
19	19.0	00.3	19.0	00.7	19.0	00.9	19.0	01.0	19.0	01.3	18.9	01.7	19
20	20.0	00.4	20.0	00.7	20.0	01.0	20.0	01.0	20.0	01.4	19.9	01.7	20
21	21.0	00.4	21.0	00.7	21.0	01.0	21.0	01.1	20.9	01.5	20.9	01.8	21
22	22.0	00.4	22.0	00.8	22.0	01.1	22.0	01.1	21.9	01.5	21.9	01.9	22
23	23.0	00.4	23.0	00.8	23.0	01.1	23.0	01.2	22.9	01.6	22.9	02.0	23
24	24.0	00.4	24.0	00.8	24.0	01.2	24.0	01.3	23.9	01.7	23.9	02.1	24
25	25.0	00.4	25.0	00.9	25.0	01.2	25.0	01.3	24.9	01.7	24.9	02.2	25
26	26.0	00.5	26.0	00.9	26.0	01.3	26.0	01.4	25.9	01.8	25.9	02.3	26
27	27.0	00.5	27.0	00.9	27.0	01.3	27.0	01.4	26.9	01.9	26.9	02.4	27
28	28.0	00.5	28.0	01.0	28.0	01.4	28.0	01.5	27.9	02.0	27.9	02.4	28
29	29.0	00.5	29.0	01.0	29.0	01.4	29.0	01.5	28.9	02.0	28.9	02.5	29
30	30.0	00.5	30.0	01.1	30.0	01.5	30.0	01.6	29.9	02.1	29.9	02.6	30
31	31.0	00.5	31.0	01.1	31.0	01.5	31.0	01.6	30.9	02.2	30.9	02.7	31
32	32.0	00.6	32.0	01.1	32.0	01.6	32.0	01.7	31.9	02.2	31.9	02.8	32
33	33.0	00.6	33.0	01.1	33.0	01.6	33.0	01.7	32.9	02.3	32.9	02.9	33
34	34.0	00.6	34.0	01.2	34.0	01.7	34.0	01.8	33.9	02.4	33.9	03.0	34
35	35.0	00.6	35.0	01.2	35.0	01.7	35.0	01.8	34.9	02.4	34.9	03.1	35
36	36.0	00.6	36.0	01.3	36.0	01.8	36.0	01.9	35.9	02.5	35.9	03.1	36
37	37.0	00.6	37.0	01.3	37.0	01.8	36.9	01.9	36.9	02.6	36.9	03.2	37
38	38.0	00.7	38.0	01.3	38.0	01.9	37.9	02.0	37.9	02.7	37.9	03.3	38
39	39.0	00.7	39.0	01.4	39.0	01.9	38.9	02.0	38.9	02.7	38.9	03.4	39
40	40.0	00.7	40.0	01.4	40.0	02.0	39.9	02.1	39.9	02.8	39.8	03.5	40
41	41.0	00.7	41.0	01.4	41.0	02.0	40.9	02.1	40.9	02.9	40.8	03.6	41
42	42.0	00.7	42.0	01.5	41.9	02.1	41.9	02.2	41.9	03.0	41.8	03.7	42
43	43.0	00.8	43.0	01.5	42.9	02.1	42.9	02.2	42.9	03.0	42.8	03.8	43
44	44.0	00.8	44.0	01.5	43.9	02.2	43.9	02.3	43.9	03.1	43.8	03.8	44
45	45.0	00.8	45.0	01.6	44.9	02.2	44.9	02.4	44.9	03.1	44.8	03.9	45
46	46.0	00.8	46.0	01.6	45.9	02.3	45.9	02.4	45.9	03.2	45.8	04.0	46
47	47.0	00.8	47.0	01.6	46.9	02.3	46.9	02.5	46.9	03.3	46.8	04.1	47
48	48.0	00.8	48.0	01.7	47.9	02.4	47.9	02.5	47.9	03.4	47.8	04.2	48
49	49.0	00.9	49.0	01.7	48.9	02.4	48.9	02.6	48.9	03.4	48.8	04.3	49
50	50.0	00.9	50.0	01.7	49.9	02.5	49.9	02.6	49.9	03.5	49.8	04.4	50
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	89 Deg.		88 Deg.		7 $\frac{1}{4}$ Point		87 Deg.		86 Deg.		85 Deg.		

of LATITUDE and DEPARTURE. 91

Diff.	1 Deg.		2 Deg.		$\frac{1}{2}$ Point		3 Deg.		4 Deg.		5 Deg.			Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep		
51	51.0	00.9	51.0	01.8	50.9	02.5	50.9	02.7	50.9	03.6	50.8	04.4	51	
52	52.0	00.9	52.0	01.8	51.9	02.6	51.9	02.7	51.9	03.6	51.8	04.5	52	
53	53.0	00.9	53.0	01.8	52.9	02.6	52.9	02.8	52.9	03.7	52.8	04.6	53	
54	54.0	00.9	54.0	01.9	53.9	02.7	53.9	02.8	53.9	03.8	53.8	04.7	54	
55	55.0	01.0	55.0	01.9	54.9	02.7	54.9	02.9	54.9	03.8	54.8	04.8	55	
56	56.0	01.0	56.0	02.0	55.9	02.7	55.9	02.9	55.9	03.9	55.8	04.9	56	
57	57.0	01.0	57.0	02.0	56.9	02.8	56.9	03.0	56.9	04.0	56.8	05.0	57	
58	58.0	01.0	58.0	02.0	57.9	02.8	57.9	03.0	57.9	04.0	57.8	05.1	58	
59	59.0	01.0	59.0	02.1	58.9	02.9	58.9	03.1	58.9	04.1	58.8	05.1	59	
60	60.0	01.1	60.0	02.1	59.9	02.9	59.9	03.1	59.9	04.2	59.8	05.2	60	
61	61.0	01.1	61.0	02.1	60.9	03.0	60.9	03.2	60.9	04.3	60.8	05.3	61	
62	62.0	01.1	62.0	02.2	61.9	03.0	61.9	03.2	61.9	04.3	61.8	05.4	62	
63	63.0	01.1	63.0	02.2	62.9	03.1	62.9	03.3	62.8	04.4	62.8	05.5	63	
64	64.0	01.1	64.0	02.2	63.9	03.1	63.9	03.3	63.8	04.5	63.8	05.6	64	
65	65.0	01.1	65.0	02.3	64.9	03.2	64.9	03.4	64.8	04.5	64.8	05.7	65	
66	66.0	01.2	66.0	02.3	65.9	03.2	65.9	03.5	65.8	04.6	65.7	05.8	66	
67	67.0	01.2	67.0	02.3	66.9	03.3	66.9	03.5	66.8	04.7	66.7	05.8	67	
68	68.0	01.2	68.0	02.4	67.9	03.3	67.9	03.6	67.8	04.7	67.7	05.9	68	
69	69.0	01.2	69.0	02.4	68.9	03.4	68.9	03.6	68.8	04.8	68.7	06.0	69	
70	70.0	01.2	70.0	02.4	69.9	03.4	69.9	03.7	69.8	04.9	69.7	06.1	70	
71	71.0	01.2	71.0	02.5	70.9	03.5	70.9	03.7	70.8	05.0	70.7	06.2	71	
72	72.0	01.3	72.0	02.5	71.9	03.5	71.9	03.8	71.8	05.0	71.7	06.3	72	
73	73.0	01.3	73.0	02.5	72.9	03.6	72.9	03.8	72.8	05.1	72.7	06.4	73	
74	74.0	01.3	74.0	02.6	73.9	03.6	73.9	03.9	73.8	05.2	73.7	06.5	74	
75	75.0	01.3	75.0	02.6	74.9	03.7	74.9	03.9	74.8	05.2	74.7	06.5	75	
76	76.0	01.3	76.0	02.7	75.9	03.7	75.9	04.0	75.8	05.3	75.7	06.6	76	
77	77.0	01.3	77.0	02.7	76.9	03.8	76.9	04.0	76.8	05.4	76.7	06.7	77	
78	78.0	01.4	78.0	02.7	77.9	03.8	77.9	04.1	77.8	05.4	77.7	06.8	78	
79	79.0	01.4	79.0	02.8	78.9	03.9	78.9	04.1	78.8	05.5	78.7	06.9	79	
80	80.0	01.4	80.0	02.8	79.9	03.9	79.9	04.2	79.8	05.6	79.7	07.0	80	
81	81.0	01.4	81.0	02.8	80.9	04.0	80.9	04.2	80.8	05.7	80.7	07.1	81	
82	82.0	01.4	81.9	02.9	81.9	04.0	81.9	04.3	81.8	05.7	81.7	07.2	82	
83	83.0	01.5	82.9	02.9	82.9	04.1	82.9	04.3	82.8	05.8	82.7	07.2	83	
84	84.0	01.5	83.9	02.9	83.9	04.1	83.9	04.4	83.8	05.9	83.7	07.3	84	
85	85.0	01.5	84.9	03.0	84.9	04.2	84.9	04.4	84.8	05.9	84.7	07.4	85	
86	86.0	01.5	85.9	03.0	85.9	04.2	85.9	04.5	85.8	06.0	85.7	07.5	86	
87	87.0	01.5	86.9	03.0	86.9	04.3	86.9	04.6	86.8	06.1	86.7	07.6	87	
88	88.0	01.5	87.9	03.1	87.9	04.3	87.9	04.6	87.8	06.1	87.7	07.7	88	
89	89.0	01.6	88.9	03.1	88.9	04.4	88.9	04.7	88.8	06.2	88.7	07.8	89	
90	90.0	01.6	89.9	03.1	89.9	04.4	89.9	04.7	89.8	06.3	89.7	07.8	90	
91	91.0	01.6	90.9	03.2	90.9	04.5	90.9	04.8	90.8	06.4	90.7	07.9	91	
92	92.0	01.6	91.9	03.2	91.9	04.5	91.9	04.8	91.8	06.4	91.6	08.0	92	
93	93.0	01.6	92.9	03.2	92.9	04.6	92.9	04.9	92.8	06.5	92.6	08.1	93	
94	94.0	01.6	93.9	03.3	93.9	04.6	93.9	04.9	93.8	06.6	93.6	08.2	94	
95	95.0	01.7	94.9	03.3	94.9	04.7	94.9	05.0	94.8	06.6	94.6	08.3	95	
96	96.0	01.7	95.9	03.4	95.9	04.7	95.9	05.0	95.8	06.7	95.6	08.4	96	
97	97.0	01.7	96.9	03.4	96.9	04.8	96.9	05.1	96.8	06.8	96.6	08.5	97	
98	98.0	01.7	97.9	03.4	97.9	04.8	97.9	05.1	97.8	06.8	97.6	08.5	98	
99	99.0	01.7	98.9	03.5	98.9	04.9	98.9	05.2	98.8	06.9	98.6	08.6	99	
100	10.0	01.7	99.9	03.5	99.9	04.9	99.9	05.2	99.8	07.0	99.6	08.7	100	
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.	
	89 Deg.		88 Deg.		7 $\frac{1}{2}$ Point		87 Deg.		86 Deg.		85 Deg.			

Diff.	$\frac{1}{2}$ Point		6 Deg.		7 Deg.		8 Deg.		$\frac{1}{2}$ Point		9 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.2	1
2	02.0	00.2	02.0	00.2	02.0	00.2	02.0	00.3	02.0	00.3	02.0	00.3	2
3	03.0	00.3	03.0	00.3	03.0	00.4	03.0	00.4	03.0	00.4	03.0	00.5	3
4	04.0	00.4	04.0	00.4	04.0	00.5	04.0	00.6	04.0	00.6	04.0	00.6	4
5	05.0	00.5	05.0	00.5	05.0	00.6	05.0	00.7	04.9	00.7	04.9	00.8	5
6	06.0	00.6	06.0	00.6	06.0	00.7	05.9	00.8	05.9	00.9	05.9	00.9	6
7	07.0	00.7	07.0	00.7	06.9	00.9	06.9	01.0	06.9	01.0	06.9	01.1	7
8	08.0	00.8	08.0	00.8	07.9	01.0	07.9	01.1	07.9	01.2	07.9	01.3	8
9	09.0	00.9	08.9	00.9	08.9	01.1	08.9	01.3	08.9	01.3	08.9	01.4	9
10	10.0	01.0	09.9	01.0	09.9	01.2	09.9	01.4	09.9	01.5	09.9	01.6	10
11	10.9	01.1	10.9	01.1	10.9	01.3	10.9	01.5	10.9	01.6	10.9	01.7	11
12	11.9	01.2	11.9	01.3	11.9	01.5	11.9	01.7	11.9	01.8	11.9	01.9	12
13	12.9	01.3	12.9	01.4	12.9	01.6	12.9	01.8	12.9	01.9	12.9	02.0	13
14	13.9	01.4	13.9	01.5	13.9	01.7	13.9	01.9	13.8	02.1	13.8	02.2	14
15	14.9	01.5	14.9	01.6	14.9	01.8	14.9	02.1	14.8	02.2	14.8	02.3	15
16	15.9	01.6	15.9	01.7	15.9	01.9	15.8	02.2	15.8	02.3	15.8	02.5	16
17	16.9	01.7	16.9	01.8	16.9	02.1	16.8	02.4	16.8	02.5	16.8	02.7	17
18	17.9	01.8	17.9	01.9	17.9	02.2	17.8	02.5	17.8	02.6	17.8	02.8	18
19	18.9	01.9	18.9	02.0	18.9	02.3	18.8	02.6	18.8	02.8	18.8	03.0	19
20	19.9	02.0	19.9	02.1	19.9	02.4	19.8	02.8	19.8	02.9	19.8	03.1	20
21	20.9	02.1	20.9	02.2	20.8	02.6	20.8	02.9	20.8	03.1	20.7	03.3	21
22	21.9	02.2	21.9	02.3	21.8	02.7	21.8	03.1	21.8	03.2	21.7	03.4	22
23	22.9	02.3	22.9	02.4	22.8	02.8	22.8	03.2	22.8	03.4	22.7	03.6	23
24	23.9	02.4	23.9	02.5	23.8	02.9	23.8	03.3	23.7	03.5	23.7	03.8	24
25	24.9	02.4	24.9	02.6	24.8	03.0	24.8	03.5	24.7	03.7	24.7	03.9	25
26	25.9	02.5	25.9	02.7	25.8	03.2	25.7	03.6	25.7	03.8	25.7	04.1	26
27	26.9	02.6	26.9	02.8	26.8	03.3	26.7	03.8	26.7	04.0	26.7	04.2	27
28	27.9	02.7	27.8	02.9	27.8	03.4	27.7	03.9	27.7	04.1	27.7	04.4	28
29	28.9	02.8	28.8	03.0	28.8	03.5	28.7	04.0	28.7	04.3	28.6	04.5	29
30	29.9	02.9	29.8	03.1	29.8	03.7	29.7	04.2	29.7	04.4	29.6	04.7	30
31	30.8	03.0	30.8	03.2	30.8	03.8	30.7	04.3	30.7	04.5	30.6	04.8	31
32	31.8	03.1	31.8	03.3	31.8	03.9	31.7	04.5	31.7	04.7	31.6	05.0	32
33	32.8	03.2	32.8	03.4	32.8	04.0	32.7	04.6	32.6	04.8	32.6	05.2	33
34	33.8	03.3	33.8	03.6	33.7	04.1	33.7	04.7	33.6	05.0	33.6	05.3	34
35	34.8	03.4	34.8	03.7	34.7	04.3	34.7	04.9	34.6	05.1	34.6	05.5	35
36	35.8	03.5	35.8	03.8	35.7	04.4	35.7	05.0	35.6	05.3	35.6	05.6	36
37	36.8	03.6	36.8	03.9	36.7	04.5	36.6	05.2	36.6	05.4	36.5	05.8	37
38	37.8	03.7	37.8	04.0	37.7	04.6	37.6	05.3	37.6	05.6	37.5	05.9	38
39	38.8	03.8	38.8	04.1	38.7	04.8	38.6	05.4	38.6	05.7	38.5	06.1	39
40	39.8	03.9	39.8	04.2	39.7	04.9	39.6	05.6	39.6	05.9	39.5	06.3	40
41	40.8	04.0	40.8	04.3	40.7	05.0	40.6	05.7	40.6	06.0	40.5	06.4	41
42	41.8	04.1	41.8	04.4	41.7	05.1	41.6	05.8	41.5	06.2	41.5	06.6	42
43	42.8	04.2	42.8	04.5	42.7	05.2	42.6	06.0	42.5	06.3	42.5	06.7	43
44	43.8	04.3	43.8	04.6	43.7	05.4	43.6	06.1	43.5	06.5	43.5	06.9	44
45	44.8	04.4	44.8	04.7	44.7	05.5	44.6	06.3	44.5	06.6	44.4	07.0	45
46	45.8	04.5	45.7	04.8	45.7	05.6	45.6	06.4	45.5	06.7	45.4	07.2	46
47	46.8	04.6	46.7	04.9	46.6	05.7	46.5	06.5	46.5	06.9	46.4	07.4	47
48	47.8	04.7	47.7	05.0	47.6	05.8	47.5	06.7	47.5	07.0	47.4	07.5	48
49	48.8	04.8	48.7	05.1	48.6	06.0	48.5	06.8	48.5	07.2	48.4	07.7	49
50	49.8	04.9	49.7	05.2	49.6	06.1	49.5	07.0	49.5	07.3	49.4	07.8	50
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	7 $\frac{1}{2}$ Points		84 Deg.		83 Deg.		82 Deg.		7 $\frac{1}{2}$ Point		81 Deg.		

of LATITUDE and DEPARTURE. 93

Diff.	1½ Point		6 Deg.		7 Deg.		8 Deg.		½ Point		9 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
51	50.8	05.0	50.7	05.3	50.6	06.2	50.5	07.1	50.4	07.5	50.4	08.0	51
52	51.7	05.1	51.7	05.4	51.6	06.3	51.5	07.2	51.4	07.6	51.4	08.1	52
53	52.7	05.2	52.7	05.5	52.6	06.5	52.5	07.4	52.4	07.8	52.3	08.3	53
54	53.7	05.3	53.7	05.6	53.6	06.6	53.5	07.5	53.4	07.9	53.3	08.4	54
55	54.7	05.4	54.7	05.7	54.6	06.7	54.5	07.7	54.4	08.1	54.3	08.6	55
56	55.7	05.5	55.7	05.9	55.6	06.8	55.5	07.8	55.4	08.2	55.3	08.8	56
57	56.7	05.6	56.7	06.0	56.6	06.9	56.4	07.9	56.4	08.4	56.3	08.9	57
58	57.7	05.7	57.7	06.1	57.6	07.1	57.4	08.1	57.4	08.5	57.3	09.1	58
59	58.7	05.8	58.7	06.2	58.6	07.2	58.4	08.2	58.4	08.7	58.3	09.2	59
60	59.7	05.9	59.7	06.3	59.6	07.3	59.4	08.4	59.4	08.8	59.3	09.4	60
61	60.7	06.0	60.7	06.4	60.5	07.4	60.4	08.5	60.3	08.9	60.2	09.5	61
62	61.7	06.1	61.7	06.5	61.5	07.5	61.4	08.6	61.3	09.1	61.2	09.7	62
63	62.7	06.2	62.7	06.6	62.5	07.7	62.4	08.8	62.3	09.2	62.2	09.9	63
64	63.7	06.3	63.6	06.7	63.5	07.8	63.4	08.9	63.3	09.4	63.2	10.0	64
65	64.7	06.4	64.6	06.8	64.5	07.9	64.4	09.0	64.3	09.5	64.2	10.2	65
66	65.7	06.5	65.6	06.9	65.5	08.0	65.4	09.2	65.3	09.7	65.2	10.3	66
67	66.7	06.6	66.6	07.0	66.5	08.2	66.4	09.3	66.3	09.8	66.2	10.5	67
68	67.7	06.7	67.6	07.1	67.5	08.3	67.3	09.5	67.3	10.0	67.2	10.6	68
69	68.7	06.8	68.6	07.2	68.5	08.4	68.3	09.6	68.3	10.1	68.2	10.8	69
70	69.7	06.9	69.6	07.3	69.5	08.5	69.3	09.7	69.2	10.3	69.1	10.9	70
71	70.7	07.0	70.6	07.4	70.5	08.6	70.3	09.9	70.2	10.4	70.1	11.1	71
72	71.7	07.1	71.6	07.5	71.5	08.8	71.3	10.0	71.2	10.6	71.1	11.3	72
73	72.6	07.2	72.6	07.6	72.5	08.9	72.3	10.2	72.2	10.7	72.1	11.4	73
74	73.6	07.3	73.6	07.7	73.4	09.0	73.3	10.3	73.2	10.9	73.1	11.6	74
75	74.6	07.3	74.6	07.8	74.4	09.1	74.3	10.4	74.2	11.0	74.1	11.7	75
76	75.6	07.4	75.6	07.9	75.4	09.3	75.3	10.6	75.2	11.1	75.1	11.9	76
77	76.6	07.5	76.6	08.0	76.4	09.4	76.3	10.7	76.2	11.3	76.1	12.0	77
78	77.6	07.6	77.6	08.1	77.4	09.5	77.2	10.9	77.2	11.4	77.0	12.2	78
79	78.6	07.7	78.6	08.3	78.4	09.6	78.2	11.0	78.1	11.6	78.0	12.4	79
80	79.6	07.8	79.6	08.4	79.4	09.7	79.2	11.1	79.1	11.7	79.0	12.5	80
81	80.6	07.9	80.6	08.5	80.4	09.9	80.2	11.3	80.1	11.9	80.0	12.7	81
82	81.6	08.0	81.5	08.6	81.4	10.0	81.2	11.4	81.1	12.0	81.0	12.8	82
83	82.6	08.1	82.5	08.7	82.4	10.1	82.2	11.6	82.1	12.2	82.0	13.0	83
84	83.6	08.2	83.5	08.8	83.4	10.2	83.2	11.7	83.1	12.3	83.0	13.1	84
85	84.6	08.3	84.5	08.9	84.4	10.4	84.2	11.8	84.1	12.5	84.0	13.3	85
86	85.6	08.4	85.5	09.0	85.4	10.5	85.2	12.0	85.1	12.6	84.9	13.5	86
87	86.6	08.5	86.5	09.1	86.3	10.6	86.2	12.1	86.0	12.8	85.9	13.6	87
88	87.6	08.6	87.5	09.2	87.3	10.7	87.1	12.2	87.0	12.9	86.9	13.8	88
89	88.6	08.7	88.5	09.3	88.3	10.8	88.1	12.4	88.0	13.1	87.9	13.9	89
90	89.6	08.8	89.5	09.4	89.3	11.0	89.1	12.5	89.0	13.2	88.9	14.1	90
91	90.6	08.9	90.5	09.5	90.3	11.1	90.1	12.7	90.0	13.4	89.9	14.2	91
92	91.6	09.0	91.5	09.6	91.3	11.2	91.1	12.8	91.0	13.5	90.9	14.4	92
93	92.6	09.1	92.5	09.7	92.3	11.3	92.1	12.9	92.0	13.6	91.9	14.5	93
94	93.5	09.2	93.5	09.8	93.3	11.5	93.1	13.1	93.0	13.8	92.8	14.7	94
95	94.5	09.3	94.5	09.9	94.3	11.6	94.1	13.2	94.0	13.9	93.8	14.9	95
96	95.5	09.4	95.5	10.0	95.3	11.7	95.1	13.3	95.0	14.1	94.8	15.0	96
97	96.5	09.5	96.5	10.1	96.3	11.8	96.1	13.5	96.0	14.2	95.8	15.2	97
98	97.5	09.6	97.5	10.2	97.3	11.9	97.0	13.6	96.9	14.4	96.8	15.3	98
99	98.5	09.7	98.5	10.3	98.3	12.1	98.0	13.8	97.9	14.5	97.8	15.5	99
100	99.5	09.8	99.5	10.3	99.3	12.2	99.0	13.9	98.9	14.7	98.8	15.6	100
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	7½ Point		84 Deg.		83 Deg.		82 Deg.		7½ Point		81 Deg.		

Diff.	10 Deg.		11 Deg.		1 Point		12 Deg.		13 Deg.		14 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	1
2	02.0	00.3	02.0	00.4	02.0	00.4	02.0	00.4	01.9	00.4	01.9	00.5	2
3	03.0	00.5	02.9	00.6	02.9	00.6	02.9	00.6	02.9	00.7	02.9	00.7	3
4	03.9	00.7	03.9	00.8	03.9	00.8	03.9	00.8	03.9	00.9	03.9	01.0	4
5	04.9	00.9	04.9	01.0	04.9	01.0	04.9	01.0	04.9	01.1	04.9	01.2	5
6	05.9	01.0	05.9	01.1	05.9	01.2	05.9	01.2	05.8	01.3	05.8	01.5	6
7	06.9	01.2	06.9	01.3	06.9	01.4	06.8	01.5	06.8	01.6	06.8	01.7	7
8	07.9	01.4	07.9	01.5	07.8	01.6	07.8	01.7	07.8	01.8	07.8	01.9	8
9	08.9	01.6	08.8	01.7	08.8	01.8	08.8	01.9	08.8	02.0	08.7	02.2	9
10	09.8	01.7	09.8	01.9	09.8	02.0	09.8	02.1	09.7	02.2	09.7	02.4	10
11	10.8	01.9	10.8	02.1	10.8	02.1	10.8	02.3	10.7	02.5	10.7	02.7	11
12	11.8	02.1	11.8	02.3	11.8	02.3	11.7	02.5	11.7	02.7	11.6	02.9	12
13	12.8	02.3	12.8	02.5	12.7	02.5	12.7	02.7	12.7	02.9	12.6	03.1	13
14	13.8	02.4	13.7	02.7	13.7	02.7	13.7	02.9	13.6	03.1	13.6	03.4	14
15	14.8	02.6	14.7	02.9	14.7	02.9	14.7	03.1	14.6	03.4	14.6	03.6	15
16	15.8	02.8	15.7	03.1	15.7	03.1	15.6	03.3	15.6	03.6	15.5	03.9	16
17	16.7	02.9	16.7	03.2	16.7	03.3	16.6	03.5	16.6	03.8	16.5	04.1	17
18	17.7	03.1	17.7	03.4	17.7	03.5	17.6	03.7	17.5	04.0	17.5	04.4	18
19	18.7	03.3	18.7	03.6	18.6	03.7	18.6	04.0	18.5	04.3	18.4	04.6	19
20	19.7	03.5	19.6	03.8	19.6	03.9	19.6	04.2	19.5	04.5	19.4	04.8	20
21	20.7	03.6	20.6	04.0	20.6	04.1	20.5	04.4	20.5	04.7	20.4	05.1	21
22	21.7	03.8	21.6	04.2	21.6	04.3	21.5	04.6	21.4	04.9	21.3	05.3	22
23	22.7	04.0	22.6	04.4	22.6	04.5	22.5	04.8	22.4	05.2	22.3	05.6	23
24	23.6	04.2	23.6	04.6	23.5	04.7	23.5	05.0	23.4	05.4	23.3	05.8	24
25	24.6	04.3	24.5	04.8	24.5	04.9	24.5	05.2	24.4	05.6	24.3	06.0	25
26	25.6	04.5	25.5	05.0	25.5	05.1	25.4	05.4	25.3	05.8	25.2	06.3	26
27	26.6	04.7	26.5	05.2	26.5	05.3	26.4	05.6	26.3	06.1	26.2	06.5	27
28	27.6	04.9	27.5	05.3	27.5	05.5	27.4	05.8	27.3	06.3	27.2	06.8	28
29	28.6	05.0	28.5	05.5	28.4	05.7	28.4	06.0	28.3	06.5	28.1	07.0	29
30	29.5	05.2	29.4	05.7	29.4	05.9	29.3	06.2	29.2	06.7	29.1	07.3	30
31	30.5	05.4	30.4	05.9	30.4	06.1	30.3	06.4	30.2	07.0	30.1	07.5	31
32	31.5	05.5	31.4	06.1	31.4	06.2	31.3	06.7	31.2	07.2	31.0	07.7	32
33	32.5	05.7	32.4	06.3	32.4	06.4	32.3	06.9	32.2	07.4	32.0	08.0	33
34	33.5	05.9	33.4	06.5	33.3	06.6	33.3	07.1	33.1	07.6	33.0	08.2	34
35	34.5	06.1	34.4	06.7	34.3	06.8	34.2	07.3	34.1	07.9	34.0	08.5	35
36	35.5	06.2	35.3	06.9	35.3	07.0	35.2	07.5	35.1	08.1	34.9	08.7	36
37	36.4	06.4	36.3	07.1	36.3	07.2	36.2	07.7	36.1	08.3	35.9	09.0	37
38	37.4	06.6	37.3	07.3	37.3	07.4	37.2	07.9	37.0	08.5	36.9	09.2	38
39	38.4	06.8	38.3	07.4	38.2	07.6	38.1	08.1	38.0	08.8	37.8	09.4	39
40	39.4	06.9	39.3	07.6	39.2	07.8	39.1	08.3	39.0	09.0	38.8	09.7	40
41	40.4	07.1	40.2	07.8	40.2	08.0	40.1	08.5	39.9	09.2	39.8	09.9	41
42	41.4	07.3	41.2	08.0	41.2	08.2	41.1	08.7	40.9	09.4	40.8	10.2	42
43	42.3	07.5	42.2	08.2	42.2	08.4	42.1	08.9	41.9	09.7	41.7	10.4	43
44	43.3	07.6	43.2	08.4	43.1	08.6	43.0	09.1	42.9	09.9	42.7	10.6	44
45	44.3	07.8	44.2	08.6	44.1	08.8	44.0	09.4	43.8	10.1	43.7	10.9	45
46	45.3	08.0	45.2	08.8	45.1	09.0	45.0	09.6	44.8	10.3	44.6	11.1	46
47	46.3	08.1	46.1	09.0	46.1	09.2	46.0	09.8	45.8	10.6	45.6	11.4	47
48	47.3	08.3	47.1	09.2	47.1	09.4	47.0	10.0	46.8	10.8	46.6	11.6	48
49	48.3	08.5	48.1	09.3	48.0	09.6	47.9	10.2	47.7	11.0	47.5	11.9	49
50	49.2	08.7	49.1	09.5	49.0	09.8	48.9	10.4	48.7	11.2	48.5	12.1	50
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	80 Deg.		79 Deg.		7 Points		78 Deg.		77 Deg.		76 Deg.		

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Diff.	10 Deg.		11 Deg.		1 Point		12 Deg.		13 Deg.		14 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
51	50.2	08.8	50.1	09.7	50.0	10.0	49.9	10.6	49.7	11.5	49.5	12.3	51
52	51.2	09.0	51.0	09.9	51.0	10.1	50.9	10.8	50.7	11.7	50.5	12.6	52
53	52.2	09.2	52.0	10.1	52.0	10.3	51.8	11.0	51.6	11.9	51.4	12.8	53
54	53.2	09.4	53.0	10.3	52.9	10.5	52.8	11.2	52.6	12.1	52.4	13.1	54
55	54.2	09.5	54.0	10.5	53.9	10.7	53.8	11.4	53.6	12.4	53.4	13.3	55
56	55.1	09.7	55.0	10.7	54.9	10.9	54.8	11.6	54.6	12.6	54.3	13.6	56
57	56.1	09.9	56.0	10.9	55.9	11.1	55.7	11.7	55.5	12.8	55.3	13.8	57
58	57.1	10.1	56.9	11.1	56.9	11.3	56.7	12.1	56.5	13.0	56.3	14.0	58
59	58.1	10.2	57.9	11.3	57.9	11.5	57.7	12.3	57.5	13.3	57.2	14.3	59
60	59.1	10.4	58.9	11.4	58.8	11.7	58.7	12.5	58.5	13.5	58.2	14.5	60
61	60.1	10.6	59.9	11.6	59.8	11.9	59.7	12.7	59.4	13.7	59.2	14.8	61
62	61.1	10.8	60.9	11.8	60.8	12.1	60.6	12.9	60.4	13.9	60.2	15.0	62
63	62.0	10.9	61.8	12.0	61.8	12.3	61.6	13.1	61.4	14.2	61.1	15.2	63
64	63.0	11.1	62.8	12.2	62.8	12.5	62.6	13.3	62.4	14.4	62.1	15.5	64
65	64.0	11.2	63.8	12.4	63.7	12.7	63.6	13.5	63.3	14.6	63.1	15.7	65
66	65.0	11.4	64.8	12.7	64.7	12.9	64.6	13.7	64.3	14.8	64.0	16.0	66
67	66.0	11.6	65.8	12.8	65.7	13.1	65.5	13.9	65.3	15.1	65.0	16.2	67
68	67.0	11.8	66.7	13.0	66.7	13.3	66.5	14.1	66.3	15.3	66.0	16.5	68
69	68.0	12.0	67.7	13.2	67.7	13.5	67.5	14.4	67.2	15.5	66.9	16.7	69
70	68.9	12.2	68.7	13.4	68.7	13.7	68.5	14.6	68.2	15.7	67.9	16.9	70
71	69.9	12.3	69.7	13.5	69.6	13.9	69.4	14.8	69.2	16.0	68.9	17.2	71
72	70.9	12.5	70.7	13.7	70.6	14.1	70.4	15.0	70.2	16.2	69.9	17.4	72
73	71.9	12.7	71.7	13.9	71.6	14.2	71.4	15.2	71.1	16.4	70.8	17.7	73
74	72.9	12.8	72.6	14.1	72.6	14.4	72.4	15.4	72.1	16.6	71.8	17.9	74
75	73.9	13.0	73.6	14.3	73.6	14.6	73.4	15.6	73.1	16.9	72.8	18.1	75
76	74.8	13.2	74.6	14.5	74.6	14.8	74.3	15.8	74.1	17.1	73.7	18.4	76
77	75.8	13.4	75.6	14.7	75.5	15.0	75.3	16.0	75.0	17.3	74.7	18.6	77
78	76.8	13.5	76.6	14.9	76.5	15.2	76.3	16.2	76.0	17.5	75.7	18.8	78
79	77.8	13.7	77.5	15.1	77.5	15.4	77.3	16.4	77.0	17.8	76.7	19.1	79
80	78.8	13.9	78.5	15.3	78.5	15.6	78.2	16.6	78.0	18.0	77.6	19.4	80
81	79.8	14.0	79.5	15.5	79.5	15.8	79.2	16.8	78.9	18.2	78.6	19.6	81
82	80.8	14.2	80.5	15.6	80.4	16.0	80.2	17.1	79.9	18.4	79.6	19.8	82
83	81.7	14.4	81.5	15.8	81.4	16.2	81.2	17.3	80.9	18.7	80.5	20.1	83
84	82.7	14.6	82.5	16.0	82.4	16.4	82.2	17.5	81.8	18.9	81.5	20.3	84
85	83.7	14.7	83.4	16.2	83.4	16.6	83.1	17.7	82.8	19.1	82.5	20.6	85
86	84.7	14.9	84.4	16.4	84.4	16.8	84.1	17.9	83.8	19.3	83.4	20.8	86
87	85.7	15.1	85.4	16.6	85.3	17.0	85.1	18.0	84.8	19.6	84.4	21.1	87
88	86.7	15.3	86.4	16.8	86.3	17.2	86.1	18.3	85.7	19.8	85.4	21.3	88
89	87.6	15.4	87.4	17.0	87.3	17.4	87.0	18.5	86.7	20.0	86.4	21.5	89
90	88.6	15.6	88.3	17.2	88.3	17.6	88.0	18.7	87.7	20.2	87.3	21.8	90
91	89.6	15.8	89.3	17.4	89.3	17.8	89.0	18.9	88.7	20.5	88.3	22.0	91
92	90.6	16.0	90.3	17.6	90.3	17.9	90.0	19.1	89.6	20.7	89.3	22.3	92
93	91.6	16.1	91.3	17.7	91.3	18.1	91.0	19.3	90.6	20.9	90.2	22.5	93
94	92.6	16.3	92.3	17.9	92.2	18.3	91.9	19.6	91.6	21.1	91.2	22.7	94
95	93.6	16.5	93.3	18.1	93.2	18.5	92.9	19.8	92.6	21.4	92.2	23.0	95
96	94.5	16.6	94.2	18.3	94.2	18.7	93.9	20.0	93.5	21.6	93.1	23.2	96
97	95.5	16.8	95.2	18.5	95.2	18.9	94.9	20.2	94.5	21.8	94.1	23.5	97
98	96.5	17.0	96.2	18.7	96.1	19.1	95.8	20.4	95.5	22.0	95.1	23.7	98
99	97.5	17.2	97.2	18.9	97.1	19.3	96.8	20.6	96.5	22.3	96.1	23.9	99
100	98.5	17.3	98.2	19.1	98.1	19.5	97.8	20.8	97.4	22.5	97.0	24.2	100
Diff.	80 Deg.		79 Deg.		7 Points		78 Deg.		77 Deg.		76 Deg.		Diff.

Diff.	1½ Points		15 Deg.		16 Deg.		1½ Point		17 Deg.		18 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	01.0	00.2	01.0	00.3	01.0	00.3	01.0	00.3	01.0	00.3	01.0	00.3	1
2	01.9	00.5	01.9	00.5	01.9	00.6	01.9	00.6	01.9	00.6	01.9	00.6	2
3	02.9	00.7	02.9	00.8	02.9	00.8	02.9	00.9	02.9	00.9	02.9	00.9	3
4	03.9	01.0	03.9	01.0	03.8	01.1	03.8	01.2	03.8	01.2	03.8	01.2	4
5	04.9	01.2	04.8	01.3	04.8	01.4	04.8	01.5	04.8	01.5	04.8	01.5	5
6	05.8	01.5	05.8	01.6	05.8	01.7	05.7	01.7	05.7	01.8	05.7	01.9	6
7	06.8	01.7	06.8	01.8	06.7	01.9	06.7	02.0	06.7	02.0	06.7	02.2	7
8	07.8	01.9	07.7	02.1	07.7	02.2	07.7	02.3	07.6	02.3	07.6	02.5	8
9	08.7	02.2	08.7	02.3	08.7	02.5	08.6	02.6	08.6	02.6	08.6	02.8	9
10	09.7	02.4	09.7	02.6	09.6	02.8	09.6	02.9	09.6	02.9	09.5	03.1	10
11	10.7	02.7	10.6	02.8	10.6	03.0	10.5	03.2	10.5	03.2	10.5	03.4	11
12	11.6	02.9	11.6	03.1	11.5	03.3	11.5	03.5	11.5	03.5	11.4	03.7	12
13	12.6	03.2	12.6	03.4	12.5	03.6	12.4	03.8	12.4	03.8	12.4	04.0	13
14	13.6	03.4	13.5	03.6	13.5	03.9	13.4	04.1	13.4	04.1	13.3	04.3	14
15	14.6	03.6	14.5	03.9	14.4	04.1	14.4	04.4	14.3	04.4	14.3	04.6	15
16	15.5	03.9	15.5	04.1	15.4	04.4	15.3	04.6	15.3	04.7	15.2	04.9	16
17	16.5	04.1	16.4	04.4	16.3	04.7	16.3	04.9	16.3	05.0	16.2	05.3	17
18	17.5	04.4	17.4	04.7	17.3	05.0	17.2	05.2	17.2	05.3	17.1	05.6	18
19	18.4	04.6	18.4	04.9	18.3	05.2	18.2	05.5	18.2	05.6	18.1	05.9	19
20	19.4	04.9	19.3	05.2	19.2	05.5	19.1	05.8	19.1	05.8	19.0	06.2	20
21	20.4	05.1	20.3	05.4	20.2	05.8	20.1	06.1	20.1	06.1	20.0	06.5	21
22	21.3	05.3	21.2	05.7	21.1	06.1	21.1	06.4	21.0	06.4	20.9	06.8	22
23	22.3	05.6	22.2	06.0	22.1	06.3	22.0	06.7	22.0	06.7	21.9	07.1	23
24	23.3	05.8	23.2	06.2	23.1	06.6	23.0	07.0	22.9	07.0	22.8	07.4	24
25	24.3	06.1	24.1	06.5	24.0	06.9	23.9	07.3	23.9	07.3	23.8	07.7	25
26	25.2	06.3	25.1	06.7	25.0	07.2	24.9	07.5	24.9	07.6	24.7	08.0	26
27	26.2	06.6	26.1	07.0	26.0	07.4	25.8	07.8	25.8	07.9	25.7	08.3	27
28	27.2	06.8	27.0	07.2	26.9	07.7	26.8	08.1	26.8	08.2	26.6	08.7	28
29	28.1	07.0	28.0	07.5	27.9	08.0	27.8	08.4	27.7	08.5	27.6	09.0	29
30	29.1	07.3	29.0	07.8	28.8	08.3	28.7	08.7	28.7	08.8	28.5	09.3	30
31	30.1	07.5	29.9	08.0	29.8	08.5	29.7	09.0	29.6	09.1	29.5	09.6	3

Diff.	1½ Point		15 Deg.		16 Deg.		1½ Point		17 Deg.		18 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
51	49.5	12.4	49.3	13.2	49.0	14.1	48.8	14.8	48.8	14.9	48.5	15.8	51
52	50.4	12.6	50.2	13.5	50.0	14.3	49.8	15.1	49.7	15.2	49.4	16.1	52
53	51.4	12.9	51.2	13.7	50.9	14.6	50.7	15.4	50.7	15.5	50.4	16.4	53
54	52.4	13.1	52.2	14.0	51.9	14.9	51.7	15.7	51.6	15.8	51.3	16.7	54
55	53.4	13.4	53.1	14.2	52.9	15.2	52.6	16.0	52.6	16.1	52.3	17.0	55
56	54.3	13.6	54.1	14.5	53.8	15.4	53.6	16.2	53.5	16.4	53.3	17.3	56
57	55.3	13.9	55.1	14.8	54.8	15.7	54.5	16.5	54.5	16.7	54.2	17.6	57
58	56.3	14.1	56.0	15.0	55.7	16.0	55.5	16.8	55.5	17.0	55.2	17.9	58
59	57.2	14.3	57.0	15.3	56.7	16.3	56.5	17.1	56.4	17.2	56.1	18.2	59
60	58.2	14.6	58.0	15.5	57.7	16.5	57.4	17.4	57.4	17.5	57.1	18.5	60
61	59.2	14.8	58.9	15.8	58.6	16.8	58.4	17.7	58.3	17.8	58.0	18.8	61
62	60.1	15.1	59.9	16.0	59.6	17.1	59.3	18.0	59.3	18.1	59.0	19.2	62
63	61.1	15.3	60.9	16.3	60.6	17.4	60.3	18.3	60.2	18.4	59.9	19.5	63
64	62.1	15.6	61.8	16.6	61.5	17.6	61.2	18.6	61.2	18.7	60.9	19.8	64
65	63.1	15.8	62.8	16.8	62.5	17.9	62.2	18.9	62.2	19.0	61.8	20.1	65
66	64.0	16.0	63.7	17.1	63.4	18.2	63.2	19.1	63.1	19.3	62.8	20.4	66
67	65.0	16.3	64.7	17.3	64.4	18.5	64.1	19.4	64.1	19.6	63.7	20.7	67
68	66.0	16.5	65.7	17.6	65.4	18.7	65.1	19.7	65.0	19.9	64.7	21.0	68
69	66.9	16.8	66.6	17.9	66.3	19.0	66.0	20.0	66.0	20.2	65.6	21.3	69
70	67.9	17.0	67.6	18.1	67.3	19.3	67.0	20.3	66.9	20.5	66.6	21.6	70
71	68.9	17.3	68.6	18.4	68.2	19.6	67.9	20.6	67.9	20.8	67.5	21.9	71
72	69.8	17.5	69.5	18.6	69.2	19.8	68.9	20.9	68.8	21.0	68.5	22.2	72
73	70.8	17.7	70.5	18.9	70.2	20.1	69.9	21.2	69.8	21.3	69.4	22.6	73
74	71.8	18.0	71.5	19.2	71.1	20.4	70.8	21.5	70.8	21.6	70.4	22.9	74
75	72.8	18.2	72.4	19.4	72.1	20.7	71.8	21.8	71.7	21.9	71.3	23.2	75
76	73.7	18.5	73.4	19.7	73.0	20.9	72.7	22.0	72.7	22.2	72.3	23.5	76
77	74.7	18.7	74.4	19.9	74.0	21.2	73.7	22.3	73.6	22.5	73.2	23.8	77
78	75.7	19.0	75.3	20.2	75.0	21.5	74.6	22.6	74.6	22.8	74.2	24.1	78
79	76.6	19.2	76.3	20.4	75.9	21.8	75.6	22.9	75.5	23.1	75.1	24.4	79
80	77.6	19.4	77.3	20.7	76.9	22.0	76.6	23.2	76.5	23.4	76.1	24.7	80
81	78.6	19.7	78.2	21.0	77.9	22.3	77.5	23.5	77.5	23.7	77.0	25.0	81
82	79.5	19.9	79.2	21.2	78.8	22.6	78.5	23.8	78.4	24.0	78.0	25.3	82
83	80.5	20.2	80.2	21.5	79.8	22.9	79.4	24.1	79.4	24.3	78.9	25.6	83
84	81.5	20.4	81.1	21.7	80.7	23.1	80.4	24.4	80.3	24.6	79.9	26.0	84
85	82.4	20.7	82.1	22.0	81.7	23.4	81.3	24.7	81.3	24.8	80.8	26.3	85
86	83.4	20.9	83.1	22.3	82.7	23.7	82.3	24.9	82.2	25.1	81.8	26.6	86
87	84.4	21.1	84.0	22.5	83.6	24.0	83.3	25.2	83.2	25.4	82.7	26.9	87
88	85.4	21.4	85.0	22.8	84.6	24.3	84.2	25.5	84.1	25.7	83.7	27.2	88
89	86.3	21.6	86.0	23.0	85.5	24.5	85.2	25.8	85.1	26.0	84.6	27.5	89
90	87.3	21.9	86.9	23.3	86.5	24.8	86.1	26.1	86.1	26.3	85.6	27.8	90
91	88.3	22.1	87.9	23.6	87.5	25.1	87.1	26.4	87.0	26.6	86.5	28.1	91
92	89.2	22.4	88.9	23.8	88.4	25.4	88.0	26.7	88.0	26.9	87.5	28.4	92
93	90.2	22.6	89.8	24.1	89.4	25.6	89.0	27.0	88.9	27.2	88.4	28.7	93
94	91.2	22.8	90.8	24.3	90.4	25.9	90.0	27.3	89.9	27.5	89.4	29.0	94
95	92.2	23.1	91.8	24.6	91.3	26.2	90.9	27.6	90.8	27.8	90.4	29.4	95
96	93.1	23.3	92.7	24.8	92.3	26.5	91.9	27.8	91.8	28.1	91.3	29.7	96
97	94.1	23.6	93.7	25.1	93.2	26.7	92.8	28.2	92.8	28.4	92.2	30.0	97
98	95.1	23.8	94.7	25.4	94.2	27.0	93.8	28.4	93.7	28.6	93.2	30.3	98
99	96.0	24.1	95.6	25.6	95.2	27.3	94.7	28.7	94.7	28.9	94.1	30.6	99
100	97.0	24.3	96.6	25.9	96.1	27.6	95.7	29.0	95.6	29.2	95.1	30.9	100
Diff.	6½ Point		75 Deg.		74 Deg.		6½ Point		73 Deg.		72 Deg.		Diff.
	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	

Diff.	19 Deg.		1½ Point		20 Deg.		21 Deg.		22 Deg.		2 Points		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	00.9	00.3	00.9	00.3	00.9	00.3	00.9	00.4	00.9	00.4	00.9	00.4	1
2	01.9	00.7	01.9	00.7	01.9	00.7	01.9	00.7	01.9	00.7	01.8	00.8	2
3	02.8	01.0	02.8	01.0	02.8	01.0	02.8	01.1	02.8	01.1	02.8	01.1	3
4	03.8	01.3	03.8	01.3	03.8	01.4	03.7	01.4	03.7	01.5	03.7	01.5	4
5	04.7	01.6	04.7	01.7	04.7	01.7	04.7	01.8	04.6	01.9	04.6	01.9	5
6	05.7	02.0	05.6	02.0	05.6	02.2	05.6	02.1	05.6	02.2	05.5	02.3	6
7	06.6	02.3	06.6	02.4	06.6	02.4	06.5	02.5	06.5	02.6	06.5	02.7	7
8	07.6	02.6	07.5	02.7	07.5	02.7	07.5	02.9	07.4	03.0	07.4	03.1	8
9	08.5	02.9	08.5	03.0	08.5	03.1	08.4	03.2	08.3	03.4	08.3	03.4	9
10	09.5	03.3	09.4	03.4	09.4	03.4	09.3	03.6	09.3	03.7	09.2	03.8	10
11	10.4	03.6	10.4	03.7	10.3	03.8	10.3	03.9	10.2	04.1	10.2	04.2	11
12	11.3	03.9	11.3	04.0	11.3	04.1	11.2	04.3	11.1	04.5	11.1	04.6	12
13	12.3	04.2	12.2	04.4	12.2	04.4	12.2	04.7	12.1	04.9	12.0	05.0	13
14	13.2	04.6	13.2	04.7	13.2	04.8	13.1	05.0	13.0	05.2	12.9	05.4	14
15	14.2	04.9	14.1	05.1	14.1	05.1	14.0	05.4	13.9	05.6	13.9	05.7	15
16	15.1	05.2	15.1	05.4	15.0	05.5	14.9	05.7	14.8	06.0	14.8	06.1	16
17	16.1	05.5	16.0	05.7	16.0	05.8	15.9	06.1	15.8	06.4	15.7	06.5	17
18	17.0	05.9	17.0	06.1	16.9	06.2	16.8	06.5	16.7	06.7	16.6	06.9	18
19	18.0	06.2	17.9	06.4	17.9	06.5	17.7	06.8	17.6	07.1	17.6	07.3	19
20	18.9	06.5	18.9	06.7	18.8	06.8	18.7	07.2	18.5	07.5	18.5	07.7	20
21	19.9	06.8	19.8	07.1	19.7	07.2	19.6	07.5	19.5	07.9	19.4	08.0	21
22	20.8	07.2	20.7	07.4	20.7	07.5	20.5	07.9	20.4	08.2	20.3	08.4	22
23	21.7	07.5	21.7	07.7	21.6	07.9	21.5	08.2	21.3	08.6	21.3	08.8	23
24	22.7	07.8	22.6	08.1	22.6	08.2	22.4	08.6	22.3	09.0	22.2	09.2	24
25	23.6	08.1	23.5	08.4	23.5	08.6	23.3	09.0	23.2	09.4	23.1	09.6	25
26	24.6	08.5	24.5	08.8	24.4	08.9	24.3	09.3	24.1	09.7	24.0	09.9	26
27	25.5	08.8	25.4	09.2	25.4	09.2	25.2	09.7	25.0	10.1	24.9	10.3	27
28	26.5	09.1	26.4	09.4	26.3	09.6	26.1	10.0	26.0	10.5	25.9	10.7	28
29	27.4	09.4	27.3	09.8	27.3	09.9	27.1	10.4	26.9	10.9	26.8	11.1	29
30	28.4	09.8	28.2	10.1	28.2	10.3	28.0	10.8	27.8	11.2	27.7	11.5	30
31	29.3	10.1	29.2	10.4	29.1	10.6	28.9	11.1	28.7	11.6	28.6	11.9	31
32	30.3	10.4	30.1	10.8	30.1	10.9	29.9	11.5	29.7	12.0	29.6	12.2	32
33	31.2	10.7	31.1	11.1	31.0	11.3	30.8	11.8	30.6	12.4	30.5	12.6	33
34	32.1	11.1	32.0	11.5	31.9	11.6	31.7	12.2	31.5	12.7	31.4	13.0	34
35	33.1	11.4	33.0	11.8	32.9	12.0	32.7	12.5	32.5	13.1	32.3	13.4	35
36	34.0	11.7	33.9	12.1	33.8	12.3	33.6	12.9	33.4	13.5	33.3	13.8	36
37	35.0	12.0	34.8	12.5	34.8	12.7	34.5	13.3	34.3	13.9	34.2	14.2	37
38	35.9	12.4	35.8	12.8	35.7	13.0	35.5	13.6	35.2	14.2	35.1	14.5	38
39	36.9	12.7	36.7	13.1	36.6	13.3	36.4	14.0	36.2	14.6	36.0	14.9	39
40	37.8	13.0	37.7	13.5	37.6	13.7	37.3	14.3	37.1	15.0	37.0	15.3	40
41	38.8	13.3	38.6	13.8	38.5	14.0	38.3	14.7	38.0	15.4	37.9	15.7	41
42	39.7	13.7	39.5	14.1	39.5	14.4	39.2	15.1	38.9	15.7	38.8	16.1	42
43	40.7	14.0	40.5	14.5	40.4	14.7	40.1	15.4	39.9	16.1	39.7	16.5	43
44	41.6	14.3	41.4	14.8	41.3	15.0	41.1	15.8	40.8	16.5	40.6	16.8	44
45	42.5	14.7	42.4	15.2	42.3	15.4	42.0	16.1	41.7	16.9	41.6	17.2	45
46	43.5	15.0	43.3	15.5	43.2	15.7	42.9	16.5	42.7	17.2	42.5	17.6	46
47	44.4	15.3	44.3	15.8	44.2	16.1	43.9	16.8	43.6	18.6	43.4	18.0	47
48	45.4	15.6	45.2	16.2	45.1	16.4	44.8	17.2	44.5	18.0	44.4	18.4	48
49	46.3	16.0	46.1	16.5	46.0	16.8	45.7	17.6	45.4	18.4	45.3	18.8	49
50	47.3	16.3	47.1	16.8	47.0	17.1	46.7	17.9	46.4	18.7	46.2	19.1	50
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	71 Deg.		6½ Point		70 Deg.		69 Deg.		68 Deg.		6 Points		

99

Diff.	19 Deg		1½ Point		20 Deg.		21 Deg.		22 Deg		2 Point		Diff.
	Lat	D-p	Lat	Dep.	Lat	Dep	Lat	Dep.	Lat	Dep	Lat	Dep	
51	48.2	16.6	48.0	17.2	47.9	17.4	47.6	18.3	47.3	19.1	47.1	19.5	51
52	49.2	16.9	49.0	17.5	48.9	17.7	48.5	18.6	48.2	19.5	48.0	19.9	52
53	50.1	17.3	49.9	17.9	49.8	18.1	49.5	19.0	49.1	19.9	49.0	20.3	53
54	51.1	17.6	50.8	18.2	50.7	18.5	50.4	19.4	50.1	20.2	49.9	20.7	54
55	52.0	17.9	51.8	18.5	51.7	18.8	51.3	19.7	51.0	20.6	50.8	21.0	55
56	52.9	18.2	52.7	18.9	52.6	19.2	52.3	20.1	51.9	21.0	51.7	21.4	56
57	53.9	18.6	53.7	19.2	53.6	19.5	53.2	20.4	52.9	21.4	52.7	21.8	57
58	54.8	18.9	54.6	19.5	54.5	19.8	54.1	20.8	53.8	21.7	53.6	22.2	58
59	55.8	19.2	55.5	19.9	55.4	20.2	55.1	21.1	54.7	22.1	54.5	22.6	59
60	56.7	19.5	56.5	20.2	56.4	20.5	56.0	21.5	55.6	22.5	55.4	23.0	60
61	57.7	19.9	57.4	20.5	57.3	20.9	56.9	21.9	56.6	22.9	56.4	23.3	61
62	58.6	20.2	58.4	20.9	58.3	21.2	57.9	22.2	57.5	23.2	57.3	23.7	62
63	59.6	20.5	59.3	21.2	59.2	21.5	58.8	22.6	58.4	23.6	58.2	24.1	63
64	60.5	20.8	60.3	21.6	60.1	21.9	59.7	22.9	59.3	24.0	59.1	24.5	64
65	61.5	21.2	61.2	21.9	61.1	22.2	60.7	23.3	60.3	24.3	60.1	24.9	65
66	62.4	21.5	62.1	22.2	62.0	22.6	61.6	23.7	61.2	24.7	61.0	25.3	66
67	63.3	21.8	63.1	22.6	63.0	22.9	62.5	24.0	62.1	25.1	61.9	25.6	67
68	64.3	22.1	64.0	22.9	63.9	23.3	63.5	24.4	63.0	25.5	62.8	26.0	68
69	65.2	22.5	65.0	23.2	64.8	23.6	64.4	24.7	64.0	25.8	63.8	26.4	69
70	66.2	22.8	65.9	23.6	65.8	23.9	65.3	25.1	64.9	26.2	64.7	26.8	70
71	67.1	23.1	66.8	23.9	66.7	24.3	66.3	25.4	65.8	26.6	65.6	27.2	71
72	68.1	23.4	67.8	24.2	67.7	24.6	67.2	25.8	66.8	27.0	66.5	27.6	72
73	69.0	23.8	68.7	24.6	68.6	25.0	68.1	26.2	67.7	27.3	67.5	27.9	73
74	70.0	24.1	69.7	24.9	69.5	25.3	69.1	26.5	68.6	27.7	68.4	28.3	74
75	70.9	24.4	70.6	25.3	70.5	25.7	70.0	26.9	69.5	28.1	69.3	28.7	75
76	71.9	24.7	71.6	25.6	71.4	26.0	70.9	27.2	70.5	28.5	70.2	29.1	76
77	72.8	25.1	72.5	25.9	72.4	26.3	71.9	27.6	71.4	28.8	71.1	29.5	77
78	73.7	25.4	73.4	26.3	73.3	26.7	72.8	28.0	72.3	29.2	72.1	29.9	78
79	74.7	25.7	74.4	26.6	74.2	27.0	73.7	28.3	73.2	29.6	73.0	30.2	79
80	75.6	26.0	75.3	27.0	75.2	27.4	74.7	28.7	74.2	30.0	73.9	30.6	80
81	76.6	26.4	76.3	27.3	76.1	27.7	75.6	29.0	75.1	30.3	74.8	31.0	81
82	77.5	26.7	77.2	27.6	77.1	28.0	76.5	29.4	76.0	30.7	75.8	31.4	82
83	78.5	27.0	78.1	28.0	78.0	28.4	77.5	29.7	77.0	31.1	76.7	31.8	83
84	79.4	27.4	79.1	28.3	78.9	28.7	78.4	30.1	77.9	31.5	77.6	32.1	84
85	80.4	27.7	80.0	28.6	79.9	29.1	79.3	30.5	78.8	31.8	78.5	32.5	85
86	81.3	28.0	81.0	29.0	80.8	29.4	80.3	30.8	79.7	32.2	79.5	32.9	86
87	82.3	28.3	81.9	29.3	81.8	29.8	81.2	31.2	80.7	32.6	80.4	33.3	87
88	83.2	28.7	82.9	29.6	82.7	30.1	82.2	31.5	81.6	33.0	81.4	33.7	88
89	84.1	29.0	83.8	30.0	83.6	30.4	83.1	31.9	82.5	33.3	82.3	34.1	89
90	85.1	29.3	84.7	30.3	84.6	30.8	84.0	32.3	83.4	33.7	83.2	34.4	90
91	86.0	29.6	85.7	30.6	85.5	31.1	84.9	32.6	84.4	34.1	84.1	34.8	91
92	87.0	30.0	86.6	31.0	86.5	31.5	85.9	33.0	85.3	34.5	85.0	35.2	92
93	87.9	30.3	87.6	31.3	87.4	31.8	86.8	33.3	86.2	34.8	85.9	35.6	93
94	88.9	30.6	88.5	31.7	88.3	32.1	87.7	33.7	87.2	35.2	86.9	36.0	94
95	89.8	30.9	89.4	32.0	89.3	32.5	88.7	34.0	88.1	35.6	87.8	36.4	95
96	90.8	31.3	90.4	32.3	90.2	32.8	89.6	34.4	89.0	36.0	88.7	36.7	96
97	91.7	31.6	91.3	32.7	91.2	33.2	90.5	34.8	89.9	36.3	89.6	37.1	97
98	92.7	31.9	92.3	33.0	92.1	33.5	91.5	35.1	90.9	36.7	90.6	37.5	98
99	93.6	32.2	93.2	33.3	93.0	33.9	92.4	35.5	91.8	37.1	91.5	37.9	99
100	94.5	32.6	94.2	33.7	94.0	34.2	93.4	35.8	92.7	37.5	92.4	38.3	100
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	17 Deg.		6½ Point		70 Deg		69 Deg.		68 Deg.		6 Points		

100 A TABLE OF DIFFERENCE

Diff.	23 Deg.		24 Deg.		25 Deg.		2½ Point		26 Deg.		27 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.5	1
2	01.9	00.8	01.8	00.8	01.8	00.8	01.8	00.9	01.8	00.9	01.8	00.9	2
3	02.8	01.2	02.7	01.2	02.7	01.3	02.7	01.3	02.7	01.3	02.7	01.4	3
4	03.7	01.6	03.7	01.6	03.6	01.7	03.6	01.7	03.6	01.8	03.6	01.8	4
5	04.6	02.0	04.6	02.0	04.5	02.1	04.5	02.1	04.5	02.2	04.5	02.3	5
6	05.5	02.3	05.5	02.4	05.4	02.5	05.4	02.6	05.4	02.6	05.3	02.7	6
7	06.4	02.7	06.4	02.8	06.3	03.0	06.3	03.0	06.3	03.1	06.2	03.2	7
8	07.4	03.1	07.3	03.3	07.3	03.4	07.2	03.4	07.2	03.5	07.1	03.6	8
9	08.3	03.5	08.2	03.7	08.2	03.8	08.1	03.8	08.1	03.9	08.0	04.1	9
10	09.2	03.9	09.1	04.1	09.1	04.2	09.0	04.3	09.0	04.4	08.9	04.5	10
11	10.1	04.3	10.0	04.5	10.0	04.6	09.9	04.7	09.9	04.8	09.8	05.0	11
12	11.0	04.7	11.0	04.9	10.9	05.0	10.8	05.1	10.8	05.3	10.7	05.4	12
13	12.0	05.1	11.9	05.3	11.8	05.5	11.8	05.6	11.7	05.7	11.6	05.9	13
14	12.9	05.5	12.8	05.7	12.7	05.9	12.7	06.0	12.6	06.1	12.5	06.4	14
15	13.8	05.9	13.7	06.1	13.6	06.3	13.6	06.4	13.5	06.6	13.4	06.8	15
16	14.7	06.3	14.6	06.5	14.5	06.8	14.5	06.8	14.4	07.0	14.3	07.3	16
17	15.6	06.6	15.5	06.9	15.4	07.2	15.4	07.3	15.3	07.5	15.1	07.7	17
18	16.6	07.0	16.4	07.3	16.3	07.6	16.3	07.7	16.2	07.9	16.0	08.2	18
19	17.5	07.4	17.4	07.7	17.2	08.0	17.2	08.1	17.1	08.3	16.9	08.6	19
20	18.4	07.8	18.3	08.1	18.1	08.5	18.1	08.6	18.0	08.7	17.8	09.1	20
21	19.3	08.2	19.2	08.5	19.0	08.9	19.0	09.0	18.9	09.2	18.7	09.5	21
22	20.3	08.6	20.1	08.9	19.9	09.3	19.9	09.4	19.8	09.6	19.6	10.0	22
23	21.2	09.0	21.0	09.4	20.8	09.7	20.8	09.8	20.7	10.1	20.5	10.4	23
24	22.1	09.4	21.9	09.8	21.8	10.1	21.7	10.3	21.6	10.5	21.4	10.9	24
25	23.0	09.8	22.8	10.2	22.7	10.6	22.6	10.7	22.5	11.0	22.3	11.4	25
26	23.9	10.2	23.8	10.6	23.6	11.0	23.5	11.1	23.4	11.4	23.2	11.8	26
27	24.9	10.5	24.7	11.0	24.5	11.4	24.4	11.5	24.3	11.8	24.1	12.3	27
28	25.8	10.9	25.6	11.4	25.4	11.8	25.3	12.0	25.2	12.3	24.9	12.7	28
29	26.7	11.3	26.5	11.8	26.3	12.3	26.2	12.4	26.1	12.7	25.8	13.2	29
30	27.6	11.7	27.4	12.2	27.2	12.7	27.1	12.8	27.0	13.2	26.7	13.6	30
31	28.5	12.1	28.3	12.6	28.1	13.1	28.0	13.3	27.9	13.6	27.6	14.1	31
32	29.5	12.5	29.2	13.0	29.0	13.5	28.9	13.7	28.8	14.0	28.5	14.5	32
33	30.4	12.9	30.1	13.4	29.9	13.9	29.8	14.1	29.7	14.5	29.4	15.0	33
34	31.3	13.3	31.1	13.8	30.8	14.4	30.7	14.5	30.6	14.9	30.3	15.4	34
35	32.2	13.7	32.0	14.2	31.7	14.8	31.6	15.0	31.5	15.3	31.2	15.9	35
36	33.1	14.1	32.9	14.6	32.6	15.2	32.5	15.4	32.4	15.8	32.1	16.3	36
37	34.1	14.5	33.8	15.0	33.5	15.6	33.4	15.8	33.3	16.2	33.0	16.8	37
38	35.0	14.8	34.7	15.5	34.4	16.1	34.4	16.2	34.2	16.7	33.9	17.3	38
39	35.9	15.2	35.6	15.9	35.3	16.5	35.3	16.7	35.1	17.1	34.7	17.7	39
40	36.8	15.6	36.5	16.3	36.3	16.9	36.2	17.1	36.0	17.5	35.6	18.2	40
41	37.7	16.0	37.5	16.7	37.2	17.3	37.1	17.5	36.9	18.0	36.5	18.6	41
42	38.7	16.4	38.4	17.1	38.1	17.7	38.0	18.0	37.7	18.4	37.4	19.1	42
43	39.6	16.8	39.3	17.5	39.0	18.2	38.9	18.4	38.6	18.9	38.3	19.5	43
44	40.5	17.2	40.2	17.9	39.9	18.6	39.8	18.8	39.5	19.3	39.2	20.0	44
45	41.4	17.6	41.1	18.3	40.8	19.0	40.7	19.2	40.4	19.7	40.1	20.4	45
46	42.3	18.0	42.0	18.7	41.7	19.4	41.6	19.7	41.3	20.2	41.0	20.9	46
47	43.3	18.4	42.9	19.1	42.6	19.9	42.5	20.1	42.2	20.6	41.9	21.3	47
48	44.2	18.8	43.8	19.5	43.5	20.3	43.4	20.5	43.1	21.0	42.8	21.8	48
49	45.1	19.2	44.8	19.9	44.4	20.7	44.3	20.9	44.0	21.5	43.7	22.2	49
50	46.0	19.5	45.7	20.3	45.3	21.1	45.2	21.4	44.9	21.9	44.6	22.7	50
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	67 Deg.	66 Deg.	65 Deg.	5½ Points	64 Deg.	63 Deg.							

LATITUDE of DEPARTURE.

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Diff.	23 Deg.		24 Deg.		25 Deg.		2½ Point		26 Deg.		27 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
51	46.9	19.9	46.6	20.7	46.2	21.6	46.1	21.8	45.8	22.4	45.4	23.2	51
52	47.9	20.3	47.5	21.1	47.1	22.0	47.0	22.2	46.7	22.8	46.3	23.6	52
53	48.8	20.7	48.4	21.6	48.0	22.4	47.9	22.7	47.6	23.2	47.2	24.1	53
54	49.7	21.1	49.3	22.0	48.9	22.8	48.8	23.1	48.5	23.7	48.1	24.5	54
55	50.6	21.5	50.2	22.4	49.8	23.2	49.7	23.5	49.4	24.1	49.0	25.0	55
56	51.5	21.9	51.2	22.8	50.8	23.7	50.6	23.9	50.3	24.6	49.9	25.4	56
57	52.5	22.3	52.1	23.2	51.7	24.1	51.5	24.4	51.2	25.0	50.8	25.9	57
58	53.4	22.7	53.0	23.6	52.6	24.5	52.4	24.8	52.1	25.4	51.7	26.3	58
59	54.3	23.1	53.9	24.0	53.5	24.9	53.3	25.2	53.0	25.9	52.6	26.8	59
60	55.2	23.4	54.8	24.4	54.4	25.4	54.2	25.7	53.9	26.3	53.5	27.2	60
61	56.1	23.8	55.7	24.8	55.3	25.8	55.1	26.1	54.8	26.7	54.4	27.7	61
62	57.1	24.2	56.6	25.2	56.2	26.2	56.0	26.5	55.7	27.2	55.2	28.1	62
63	58.0	24.6	57.6	25.6	57.1	26.6	57.0	26.9	56.6	27.6	56.1	28.6	63
64	58.9	25.0	58.5	26.0	58.0	27.0	57.9	27.4	57.5	28.1	57.0	29.1	64
65	59.8	25.4	59.4	26.4	58.9	27.5	58.8	27.8	58.4	28.5	57.9	29.5	65
66	60.8	25.8	60.3	26.8	59.8	27.9	59.7	28.2	59.3	28.9	58.8	30.0	66
67	61.7	26.2	61.2	27.2	60.7	28.3	60.6	28.6	60.2	29.4	59.7	30.4	67
68	62.6	26.6	62.1	27.7	61.6	28.7	61.5	29.1	61.1	29.8	60.6	30.9	68
69	63.5	27.0	63.0	28.1	62.5	29.2	62.4	29.5	62.0	30.2	61.5	31.3	69
70	64.4	27.3	63.9	28.5	63.4	29.6	63.3	29.9	62.9	30.7	62.4	31.8	70
71	65.4	27.7	64.9	28.9	64.3	30.0	64.2	30.4	63.7	31.1	63.3	32.2	71
72	66.3	28.1	65.8	29.3	65.3	30.4	65.1	30.8	64.7	31.6	64.2	32.7	72
73	67.2	28.5	66.7	29.7	66.2	30.8	66.0	31.2	65.6	32.0	65.0	33.1	73
74	68.1	28.9	67.6	30.1	67.1	31.3	66.9	31.6	66.5	32.4	65.9	33.6	74
75	69.0	29.3	68.5	30.5	68.0	31.7	67.8	32.1	67.4	32.9	66.8	34.1	75
76	70.0	29.7	69.4	30.9	68.9	32.1	68.7	32.5	68.3	33.3	67.7	34.5	76
77	70.9	30.1	70.3	31.3	69.8	32.5	69.6	32.9	69.2	33.8	68.6	35.0	77
78	71.8	30.5	71.3	31.7	70.7	33.0	70.5	33.3	70.1	34.2	69.5	35.4	78
79	72.7	30.9	72.2	32.1	71.6	33.4	71.4	33.8	71.0	34.6	70.4	35.9	79
80	73.6	31.3	73.1	32.5	72.5	33.8	72.3	34.2	71.9	35.1	71.3	36.3	80
81	74.6	31.6	74.0	32.9	73.4	34.2	73.2	34.6	72.8	35.5	72.2	36.8	81
82	75.5	32.0	74.9	33.3	74.3	34.7	74.1	35.1	73.7	35.9	73.1	37.2	82
83	76.4	32.4	75.8	33.8	75.2	35.1	75.0	35.5	74.6	36.4	74.0	37.7	83
84	77.3	32.8	76.7	34.1	76.1	35.5	75.9	35.9	75.5	36.8	74.8	38.1	84
85	78.2	33.2	77.6	34.6	77.0	35.9	76.8	36.3	76.4	37.3	75.7	38.6	85
86	79.2	33.6	78.6	35.0	77.9	36.3	77.7	36.8	77.3	37.7	76.6	39.0	86
87	80.1	34.0	79.5	35.4	78.8	36.8	78.6	37.2	78.2	38.1	77.5	39.5	87
88	81.0	34.4	80.4	35.8	79.8	37.2	79.6	37.6	79.1	38.6	78.4	40.0	88
89	81.9	34.8	81.3	36.2	80.7	37.6	80.5	38.1	80.0	39.0	79.3	40.4	89
90	82.8	35.2	82.2	36.6	81.6	38.0	81.4	38.5	80.9	39.5	80.2	40.9	90
91	83.8	35.6	83.1	37.0	82.5	38.5	82.3	38.9	81.8	39.9	81.1	41.3	91
92	84.7	35.9	84.0	37.4	83.4	38.9	83.2	39.3	82.7	40.3	82.0	41.8	92
93	85.6	36.3	85.0	37.8	84.3	39.5	84.1	39.8	83.6	40.8	82.9	42.2	93
94	86.5	36.7	85.9	38.2	85.2	39.7	85.0	40.2	84.5	41.2	83.8	42.7	94
95	87.4	37.1	86.8	38.6	86.1	40.1	85.9	40.6	85.4	41.6	84.6	43.1	95
96	88.4	37.5	87.7	39.0	87.0	40.6	86.8	41.0	86.3	42.1	85.5	43.6	96
97	89.3	37.9	88.6	39.4	87.9	41.0	87.7	41.5	87.2	42.5	86.4	44.0	97
98	90.2	38.3	89.5	39.9	88.8	41.4	88.6	41.9	88.1	43.0	87.3	44.5	98
99	91.1	38.7	90.4	40.3	89.7	41.8	89.5	42.3	89.0	43.4	88.2	44.9	99
100	92.0	39.1	91.4	40.7	90.6	42.3	90.4	42.8	89.9	43.8	89.1	45.4	100
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	67 Deg.	66 Deg.	65 Deg.	64 Deg.	63 Deg.	62 Deg.	61 Deg.	60 Deg.	59 Deg.	58 Deg.	57 Deg.	56 Deg.	

Diff.	28 Deg.		2½ Points		29 Deg.		30 Deg		2½ Points		31 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	00.9	00.5	00.9	00.5	00.9	00.5	00.9	00.5	00.9	00.6	00.9	00.5	1
2	01.8	00.9	01.8	00.9	01.7	01.0	01.7	01.0	01.7	01.0	01.7	01.0	2
3	02.6	01.4	02.6	01.4	02.6	01.5	02.6	01.5	02.6	01.6	02.6	01.5	3
4	03.5	01.9	03.5	01.9	03.5	01.9	03.5	02.0	03.4	02.1	03.5	02.1	4
5	04.4	02.3	04.4	02.4	04.4	02.4	04.3	02.5	04.3	02.6	04.3	02.6	5
6	05.3	02.8	05.3	02.8	05.2	02.9	05.2	03.0	05.1	03.1	05.1	03.1	6
7	06.2	03.3	06.2	03.3	06.1	03.4	06.1	03.5	06.0	03.6	06.0	03.6	7
8	07.1	03.8	07.1	03.8	07.0	03.9	06.9	04.0	06.9	04.1	06.9	04.1	8
9	07.9	04.2	07.9	04.2	07.9	04.4	07.8	04.5	07.7	04.6	07.7	04.6	9
10	08.8	04.7	08.8	04.7	08.7	04.8	08.7	05.0	08.6	05.1	08.6	05.2	10
11	09.7	05.2	09.7	05.2	09.6	05.3	09.5	05.5	09.4	05.7	09.4	05.7	11
12	10.6	05.6	10.6	05.7	10.5	05.8	10.4	06.0	10.3	06.2	10.3	06.2	12
13	11.5	06.1	11.5	06.1	11.4	06.3	11.3	06.5	11.2	06.7	11.1	06.7	13
14	12.4	06.6	12.3	06.6	12.2	06.8	12.1	07.0	12.0	07.2	12.0	07.2	14
15	13.2	07.0	13.2	07.1	13.1	07.3	13.0	07.5	12.9	07.7	12.9	07.7	15
16	14.1	07.5	14.1	07.5	14.0	07.8	13.9	08.0	13.7	08.2	13.7	08.2	16
17	15.0	08.0	15.0	08.0	14.9	08.2	14.7	08.5	14.6	08.7	14.6	08.8	17
18	15.9	08.5	15.9	08.5	15.7	08.7	15.6	09.0	15.4	09.3	15.4	09.3	18
19	16.8	08.9	16.8	09.0	16.6	09.2	16.5	09.5	16.3	09.8	16.3	09.8	19
20	17.7	09.4	17.6	09.4	17.5	09.7	17.3	10.0	17.2	10.3	17.1	10.3	20
21	18.5	09.9	18.5	09.9	18.4	10.2	18.2	10.5	18.0	10.8	18.0	10.8	21
22	19.4	10.3	19.4	10.4	19.2	10.7	19.1	11.0	18.9	11.3	18.9	11.3	22
23	20.3	10.8	20.3	10.8	20.1	11.2	19.9	11.5	19.7	11.8	19.7	11.8	23
24	21.2	11.3	21.2	11.3	21.0	11.6	20.8	12.0	20.6	12.3	20.6	12.4	24
25	22.1	11.7	22.1	11.8	21.9	12.1	21.7	12.5	21.4	12.9	21.4	12.9	25
26	23.0	12.2	22.9	12.3	22.7	12.6	22.5	13.0	22.3	13.4	22.3	13.4	26
27	23.8	12.7	23.8	12.7	23.6	13.1	23.4	13.5	23.2	13.9	23.1	13.9	27
28	24.7	13.1	24.7	13.2	24.5	13.6	24.2	14.0	24.0	14.4	24.0	14.4	28
29	25.6	13.6	25.6	13.7	25.4	14.1	25.1	14.5	24.9	14.9	24.9	14.9	29
30	26.5	14.1	26.5	14.1	26.2	14.5	26.0	15.0	25.7	15.4	25.7	15.5	30
31	27.4	14.6	27.3	14.6	27.1	15.0	26.8	15.5	26.6	15.9	26.6	16.0	31
32	28.3	15.0	28.2	15.1	28.0	15.5	27.7	16.0	27.4	16.4	27.4	16.5	32
33	29.1	15.5	29.1	15.5	28.9	16.0	28.6	16.5	28.3	17.0	28.3	17.0	33
34	30.0	16.0	30.0	16.0	29.7	16.5	29.4	17.0	29.2	17.5	29.1	17.5	34
35	30.9	16.4	30.9	16.5	30.6	17.0	30.3	17.5	30.0	18.0	30.0	18.0	35
36	31.8	16.9	31.8	17.0	31.5	17.5	31.2	18.0	30.9	18.5	30.9	18.5	36
37	32.7	17.4	32.6	17.4	32.4	17.9	32.0	18.5	31.7	19.0	31.7	19.1	37
38	33.6	17.8	33.5	17.9	33.2	18.4	32.9	19.0	32.6	19.5	32.6	19.6	38
39	34.4	18.3	34.4	18.4	34.1	18.9	33.8	19.5	33.5	20.0	33.4	20.1	39
40	35.3	18.8	35.3	18.8	35.0	19.4	34.6	20.0	34.3	20.6	34.3	20.6	40
41	36.2	19.2	36.2	19.3	35.9	19.9	35.5	20.5	35.2	21.1	35.1	21.1	41
42	37.1	19.7	37.0	19.8	36.7	20.4	36.4	21.0	36.0	21.6	36.0	21.6	42
43	38.0	20.2	37.9	20.3	37.6	20.8	37.2	21.5	36.9	22.1	36.9	22.1	43
44	38.9	20.7	38.8	20.7	38.5	21.3	38.1	22.0	37.7	22.6	37.7	22.6	44
45	39.7	21.1	39.7	21.2	39.4	21.8	39.0	22.5	38.6	23.1	38.6	23.2	45
46	40.6	21.6	40.6	21.7	40.2	22.3	39.8	23.0	39.5	23.6	39.4	23.7	46
47	41.5	22.1	41.5	22.1	41.1	22.8	40.7	23.5	40.3	24.2	40.3	24.2	47
48	42.4	22.5	42.3	22.6	42.0	23.3	41.6	24.0	41.2	24.7	41.1	24.7	48
49	43.3	23.0	43.2	23.1	42.9	23.8	42.4	24.5	42.0	25.2	42.0	25.2	49
50	44.1	23.5	44.1	23.6	43.7	24.2	43.3	25.0	42.9	25.7	42.9	25.8	50
	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	62 Deg.	5½ Points	61 Deg.	60 Deg.	5½ Points	59 Deg.							

LATITUDE OF DEPARTURE.

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Dit.	28 Deg.		2½ Point		29 Deg.		30 Deg.		2½ Points		31 Deg.		Dit.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
51	45.0	23.9	45.0	24.0	44.6	24.7	44.2	25.5	43.7	26.2	43.7	26.3	51
52	45.9	24.4	45.9	24.5	45.5	25.2	45.0	26.0	44.6	26.7	44.6	26.8	52
53	46.8	24.9	46.7	25.0	46.4	25.7	45.9	26.5	45.5	27.2	45.4	27.3	53
54	47.7	25.4	47.6	25.4	47.2	26.2	46.8	27.0	46.3	27.8	46.3	27.8	54
55	48.6	25.8	48.5	25.9	48.1	26.7	47.6	27.5	47.2	28.3	47.1	28.3	55
56	49.4	26.3	49.4	26.4	49.0	27.1	48.5	28.0	48.0	28.8	48.0	28.8	56
57	50.3	26.8	50.3	26.9	49.9	27.6	49.4	28.5	48.9	29.3	48.9	29.4	57
58	51.2	27.2	51.2	27.3	50.7	28.1	50.2	29.0	49.7	29.8	49.7	29.9	58
59	52.1	27.7	52.0	27.8	51.6	28.6	51.1	29.5	50.6	30.3	50.6	30.4	59
60	53.0	28.2	52.9	28.3	52.5	29.1	52.0	30.0	51.5	30.8	51.4	30.9	60
61	53.9	28.6	53.8	28.7	53.4	29.6	52.8	30.5	52.3	31.4	52.3	31.4	61
62	54.7	29.1	54.7	29.2	54.2	30.1	53.7	31.0	53.2	31.9	53.1	31.9	62
63	55.6	29.6	55.6	29.7	55.1	30.5	54.6	31.5	54.0	32.4	54.0	32.4	63
64	56.5	30.0	56.4	30.2	56.0	31.0	55.4	32.0	54.9	32.9	54.9	33.0	64
65	57.4	30.5	57.3	30.6	56.8	31.5	56.3	32.5	55.8	33.4	55.7	33.5	65
66	58.3	31.0	58.2	31.1	57.7	32.0	57.2	33.0	56.6	33.9	56.6	34.0	66
67	59.2	31.5	59.1	31.6	58.6	32.5	58.0	33.5	57.5	34.4	57.4	34.5	67
68	60.0	31.9	60.0	32.1	59.5	33.0	58.9	34.0	58.3	35.0	58.3	35.0	68
69	60.9	32.4	60.9	32.5	60.3	33.5	59.8	34.5	59.2	35.5	59.1	35.5	69
70	61.8	32.9	61.7	33.0	61.2	33.9	60.6	35.0	60.0	36.1	60.0	36.0	70
71	62.7	33.3	62.6	33.5	62.1	34.4	61.5	35.5	60.8	36.5	60.8	36.6	71
72	63.6	33.8	63.5	33.9	63.0	34.9	62.4	36.0	61.8	37.0	61.7	37.1	72
73	64.5	34.3	64.4	34.4	63.8	35.4	63.2	36.5	62.6	37.6	62.6	37.6	73
74	65.3	34.7	65.3	34.9	64.7	35.9	64.1	37.0	63.5	38.0	63.4	38.1	74
75	66.2	35.2	66.2	35.3	65.6	36.4	65.0	37.5	64.3	38.6	64.3	38.6	75
76	67.1	35.7	67.0	35.8	66.5	36.8	65.8	38.0	65.2	39.1	65.1	39.1	76
77	68.0	36.2	67.9	36.3	67.3	37.3	66.7	38.5	66.0	39.6	66.0	39.7	77
78	68.9	36.6	68.8	36.8	68.2	37.8	67.5	39.0	66.9	40.1	66.8	40.2	78
79	69.8	37.1	69.7	37.2	69.1	38.3	68.4	39.5	67.8	40.6	67.7	40.7	79
80	70.6	37.6	70.6	37.7	70.0	38.8	69.3	40.0	68.6	41.1	68.6	41.2	80
81	71.5	38.0	71.4	38.2	70.8	39.3	70.1	40.5	69.5	41.6	69.4	41.7	81
82	72.4	38.5	72.3	38.6	71.7	39.8	71.0	41.0	70.3	42.1	70.3	42.2	82
83	73.3	39.0	73.2	39.1	72.6	40.2	71.9	41.5	71.2	42.7	71.1	42.7	83
84	74.2	39.4	74.1	39.6	73.5	40.7	72.7	42.0	72.0	43.2	72.0	43.2	84
85	75.1	39.9	75.0	40.1	74.3	41.2	73.6	42.5	72.9	43.7	72.8	43.8	85
86	75.9	40.4	75.9	40.5	75.2	41.7	74.5	43.0	73.8	44.2	73.7	44.3	86
87	76.8	40.8	76.7	41.0	76.1	42.2	75.3	43.5	74.6	44.7	74.6	44.8	87
88	77.7	41.3	77.6	41.5	77.0	42.7	76.2	44.0	75.5	45.2	75.4	45.3	88
89	78.6	41.8	78.5	42.0	77.8	43.1	77.1	44.5	76.3	45.7	76.3	45.8	89
90	79.5	42.3	79.4	42.4	78.7	43.6	77.9	45.0	77.2	46.3	77.1	46.4	90
91	80.4	42.7	80.3	42.9	79.6	44.1	78.8	45.5	78.1	46.8	78.0	46.9	91
92	81.2	43.2	81.1	43.4	80.5	44.6	79.7	46.0	78.9	47.3	78.8	47.4	92
93	82.1	43.7	82.0	43.8	81.3	45.1	80.5	46.5	79.8	47.8	79.7	47.9	93
94	83.0	44.1	82.9	44.3	82.2	45.6	81.4	47.0	80.6	48.3	80.6	48.4	94
95	83.9	44.6	83.8	44.8	83.1	46.1	82.3	47.5	81.5	48.8	81.4	48.9	95
96	84.8	45.1	84.7	45.2	84.0	46.5	83.1	48.0	82.3	49.3	82.3	49.4	96
97	85.7	45.5	85.6	45.7	84.8	47.0	84.0	48.5	83.2	49.9	83.1	50.0	97
98	86.5	46.0	86.4	46.2	85.7	47.5	84.9	49.0	84.1	50.4	84.0	50.5	98
99	87.4	46.5	87.3	46.6	86.6	48.0	85.7	49.5	84.9	50.9	84.8	51.0	99
100	88.3	47.0	88.2	47.1	87.5	48.5	86.6	50.0	85.8	51.4	85.7	51.5	100
Dit.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dit.
	62 Deg.		5½ Point		61 Deg.		60 Deg.		5¼ Points		59 Deg.		

Diff.	32 Deg.		33 Deg.		3 Points		34 Deg.		35 Deg.		36 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	00.8	00.5	00.8	00.5	00.8	00.6	00.8	00.6	00.8	00.6	00.8	00.6	1
2	01.7	01.1	01.7	01.1	01.7	01.1	01.7	01.1	01.6	01.1	01.6	01.2	2
3	02.5	01.6	02.5	01.6	02.5	01.7	02.5	01.7	02.5	01.7	02.4	01.8	3
4	03.4	02.1	03.4	02.2	03.3	02.2	03.3	02.2	03.3	02.3	03.2	02.4	4
5	04.3	02.7	04.2	02.7	04.2	02.8	04.1	02.8	04.1	02.9	04.0	02.9	5
6	05.1	03.2	05.0	03.4	05.0	03.3	05.0	03.3	04.9	03.4	04.9	03.5	6
7	05.9	03.7	05.9	03.8	05.8	03.9	05.8	03.9	05.7	04.0	05.7	04.1	7
8	06.8	04.2	06.7	04.3	06.7	04.4	06.6	04.5	06.6	04.6	06.5	04.7	8
9	07.6	04.8	07.5	04.9	07.5	05.0	07.5	05.0	07.4	05.2	07.3	05.3	9
10	08.5	05.3	08.4	05.4	08.3	05.6	08.3	05.6	08.2	05.7	08.1	05.9	10
11	09.3	05.8	09.2	06.0	09.1	06.2	09.1	06.2	09.0	06.3	08.9	06.5	11
12	10.2	06.4	10.1	06.5	10.0	06.7	09.9	06.7	09.8	06.9	09.7	07.1	12
13	11.0	06.9	10.9	07.1	10.8	07.2	10.8	07.3	10.6	07.5	10.5	07.6	13
14	11.9	07.4	11.7	07.6	11.6	07.8	11.6	07.8	11.5	08.0	11.3	08.1	14
15	12.7	08.0	12.6	08.2	12.4	08.3	12.4	08.4	12.3	08.6	12.1	08.8	15
16	13.6	08.5	13.4	08.7	13.3	08.9	13.3	08.9	13.1	09.2	12.9	09.4	16
17	14.4	09.0	14.3	09.3	14.1	09.4	14.1	09.5	13.9	09.7	13.8	10.0	17
18	15.3	09.5	15.1	09.8	15.0	10.0	14.9	10.1	14.7	10.3	14.6	10.6	18
19	16.1	10.1	15.9	10.3	15.8	10.6	15.8	10.6	15.6	10.9	15.4	11.2	19
20	17.0	10.6	16.8	10.9	16.6	11.1	16.6	11.2	16.4	11.5	16.2	11.8	20
21	17.8	11.1	17.6	11.4	17.5	11.7	17.4	11.7	17.2	12.0	17.0	12.3	21
22	18.7	11.7	18.4	12.0	18.3	12.2	18.2	12.3	18.0	12.6	17.8	12.9	22
23	19.5	12.2	19.3	12.5	19.1	12.8	19.1	12.9	18.8	13.2	18.6	13.5	23
24	20.4	12.7	20.1	13.1	20.0	13.3	19.9	13.4	19.6	13.8	19.4	14.1	24
25	21.2	13.3	21.0	13.6	20.8	13.9	20.7	14.0	20.5	14.3	20.2	14.7	25
26	22.0	13.8	21.8	14.2	21.6	14.4	21.6	14.5	21.3	14.9	21.0	15.3	26
27	22.9	14.3	22.6	14.7	22.4	15.0	22.4	15.1	22.1	15.5	21.8	15.9	27
28	23.7	14.8	23.5	15.2	23.1	15.6	23.2	15.7	22.9	16.1	22.7	16.5	28
29	24.6	15.4	24.3	15.8	24.1	16.1	24.0	16.2	23.8	16.6	23.5	17.0	29
30	25.4	15.9	25.2	16.3	24.9	16.7	24.9	16.8	24.6	17.2	24.3	17.6	30
31	26.3	16.4	26.0	16.9	25.8	17.2	25.7	17.3	25.4	17.8	25.1	18.2	31
32	27.1	17.0	26.8	17.4	26.6	17.8	26.5	17.9	26.2	18.4	25.9	18.8	32
33	28.0	17.5	27.7	18.0	27.4	18.3	27.4	18.5	27.0	18.9	26.7	19.4	33
34	28.8	18.0	28.5	18.5	28.3	18.9	28.2	19.0	27.8	19.5	27.5	20.0	34
35	29.7	18.6	29.4	19.1	29.1	19.4	29.0	19.6	28.7	20.1	28.3	20.6	35
36	30.5	19.1	30.2	19.6	29.9	20.0	29.8	20.1	29.5	20.6	29.1	21.2	36
37	31.4	19.6	31.0	20.2	30.8	20.6	30.7	20.7	30.3	21.2	29.9	21.7	37
38	32.2	20.1	31.9	20.7	31.6	21.1	31.5	21.2	31.1	21.8	30.7	22.3	38
39	33.1	20.7	32.7	21.2	32.3	21.7	32.3	21.8	31.9	22.4	31.6	22.9	39
40	33.9	21.2	33.5	21.8	33.3	22.2	33.2	22.4	32.8	22.9	32.4	23.5	40
41	34.8	21.7	34.4	22.3	34.1	22.8	34.0	22.9	33.6	23.5	33.2	24.1	41
42	35.6	22.3	35.2	22.9	34.9	23.3	34.8	23.5	34.4	24.1	34.0	24.7	42
43	36.5	22.8	36.1	23.4	35.8	23.9	35.6	24.0	35.2	24.7	34.8	25.3	43
44	37.3	23.3	36.9	24.0	36.6	24.4	36.5	24.6	36.0	25.2	35.6	25.9	44
45	38.2	23.9	37.7	24.5	37.4	25.0	37.3	25.2	36.9	25.8	36.4	26.5	45
46	39.0	24.4	38.6	25.1	38.2	25.6	38.1	25.7	37.7	26.4	37.2	27.0	46
47	39.9	24.9	39.4	25.6	39.1	26.1	39.0	26.3	38.5	27.0	38.0	27.6	47
48	40.7	25.4	40.3	26.1	39.9	26.7	39.8	26.8	39.3	27.5	38.8	28.2	48
49	41.6	26.0	41.1	26.7	40.7	27.2	40.6	27.4	40.1	28.1	39.6	28.8	49
50	42.4	26.5	41.9	27.2	41.6	27.8	41.5	28.0	41.0	28.7	40.5	29.4	50
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	58 Deg.		57 Deg.		5 Points		56 Deg.		55 Deg.		54 Deg.		

of LATITUDE and DEPARTURE.

105

Diff.	32 Deg.		33 Deg.		3 Points		34 Deg.		35 Deg.		36 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
51	43.2	27.0	42.8	27.8	42.4	28.3	42.3	28.5	41.8	29.2	41.3	30.0	51
52	44.1	27.6	43.6	28.3	43.2	28.9	43.1	29.1	42.6	29.8	42.1	30.6	52
53	44.9	28.1	44.4	28.9	44.1	29.4	43.9	29.6	43.4	30.4	42.9	31.2	53
54	45.8	28.6	45.3	29.4	44.9	30.0	44.8	30.2	44.2	31.0	43.7	31.7	54
55	46.6	29.2	46.1	30.0	45.7	30.6	45.5	30.8	45.0	31.5	44.5	32.3	55
56	47.5	29.7	47.0	30.5	46.6	31.1	46.4	31.3	45.9	32.1	45.3	32.9	56
57	48.3	30.2	47.8	31.0	47.4	31.7	47.3	31.9	46.7	32.7	46.1	33.5	57
58	49.2	30.7	48.6	31.6	48.2	32.2	48.1	32.4	47.5	33.3	46.9	34.1	58
59	50.0	31.3	49.5	32.1	49.1	32.8	48.9	33.0	48.3	33.8	47.7	34.7	59
60	50.9	31.8	50.3	32.7	49.9	33.3	49.7	33.6	49.1	34.4	48.5	35.3	60
61	51.7	32.3	51.2	33.2	50.7	33.8	50.6	34.1	50.0	35.0	49.3	35.9	61
62	52.6	32.8	52.0	33.8	51.9	34.4	51.4	34.7	50.8	35.6	50.2	36.4	62
63	53.4	33.4	52.8	34.3	52.4	35.0	52.2	35.2	51.6	36.1	51.0	37.0	63
64	54.3	33.9	53.7	34.9	53.2	35.6	53.1	35.8	52.4	36.7	51.8	37.6	64
65	55.1	34.5	54.5	35.4	54.0	36.1	53.9	36.3	53.2	37.3	52.6	38.2	65
66	56.0	35.0	55.3	35.9	54.9	36.7	54.7	36.9	54.1	37.9	53.4	38.8	66
67	56.8	35.5	56.2	36.5	55.7	37.2	55.5	37.5	54.9	38.4	54.2	39.4	67
68	57.7	36.0	57.0	37.0	56.5	37.8	56.4	38.0	55.7	39.0	55.0	40.0	68
69	58.5	36.6	57.9	37.6	57.4	38.3	57.2	38.6	56.5	39.6	55.8	40.6	69
70	59.4	37.1	58.7	38.1	58.2	38.9	58.0	39.1	57.3	40.1	56.6	41.1	70
71	60.2	37.6	59.5	38.7	59.9	39.4	58.9	39.7	58.1	40.7	57.4	41.7	71
72	61.1	38.2	60.4	39.2	59.9	40.0	59.7	40.3	59.0	41.3	58.2	42.3	72
73	61.9	38.7	61.2	39.8	60.7	40.6	60.5	40.8	59.8	41.9	59.1	42.9	73
74	62.8	39.4	62.1	40.3	61.5	41.1	61.3	41.4	60.6	42.4	59.9	43.5	74
75	63.6	39.8	62.9	40.8	62.4	41.7	62.2	41.9	61.4	43.0	60.7	44.1	75
76	64.4	40.3	63.7	41.4	63.2	42.2	63.0	42.5	62.2	43.6	61.5	44.7	76
77	65.3	40.8	64.6	41.9	64.0	42.8	63.8	43.1	63.1	44.2	62.3	45.3	77
78	66.1	41.3	65.4	42.5	64.8	43.3	64.7	43.6	63.9	44.7	63.1	45.8	78
79	67.0	41.9	66.2	43.0	65.7	43.9	65.5	44.2	64.7	45.3	63.9	46.4	79
80	67.8	42.4	67.1	43.6	66.5	44.4	66.3	44.7	65.5	45.9	64.7	47.0	80
81	68.7	42.9	67.9	44.1	67.3	45.0	67.1	45.3	66.3	46.5	65.5	47.6	81
82	69.5	43.5	68.8	44.7	68.2	45.6	68.0	45.9	67.2	47.0	66.3	48.2	82
83	70.4	44.0	69.6	45.2	69.0	46.1	68.8	46.4	68.0	47.6	67.1	48.8	83
84	71.2	44.5	70.4	45.7	69.8	46.7	69.6	47.0	68.8	48.2	68.0	49.4	84
85	72.1	45.1	71.3	46.3	70.7	47.2	70.5	47.5	69.6	48.7	68.8	50.0	85
86	72.9	45.6	72.1	46.8	71.5	47.8	71.3	48.1	70.4	49.3	69.6	50.6	86
87	73.8	46.1	73.0	47.4	72.3	48.3	72.1	48.7	71.3	49.9	70.4	51.1	87
88	74.6	46.6	73.8	47.9	73.2	48.9	73.0	49.2	72.1	50.5	71.2	51.7	88
89	75.5	47.2	74.6	48.5	74.0	49.4	73.8	49.8	72.9	51.0	72.0	52.3	89
90	76.3	47.7	75.5	49.0	74.8	50.0	74.6	50.3	73.7	51.6	72.8	52.9	90
91	77.2	48.2	76.3	49.6	75.7	50.6	75.4	50.9	74.5	52.2	73.6	53.5	91
92	78.0	48.8	77.2	50.1	76.5	51.1	76.3	51.4	75.3	52.8	74.4	54.1	92
93	78.9	49.3	78.0	50.6	77.3	51.7	77.1	52.0	76.2	53.3	75.2	54.7	93
94	79.7	49.8	78.8	51.2	78.1	52.2	77.9	52.6	77.0	53.9	76.0	55.3	94
95	80.6	50.4	79.7	51.7	79.0	52.8	78.8	53.1	77.8	54.5	76.9	55.8	95
96	81.4	50.9	80.5	52.3	79.8	53.3	79.6	53.7	78.6	55.1	77.7	56.4	96
97	82.3	51.4	81.6	52.8	80.3	53.9	80.4	54.2	79.5	55.6	78.5	57.0	97
98	83.1	51.9	82.2	53.4	81.5	54.4	81.2	54.8	80.3	56.2	79.3	57.6	98
99	84.0	52.5	83.0	53.9	82.3	55.0	82.1	55.4	81.1	56.8	80.1	58.2	99
100	84.8	53.0	83.9	54.5	83.1	55.6	82.9	55.9	81.9	57.4	80.9	58.8	100
Diff.	58 Deg.		57 Deg.		5 Point.		56 Deg.		55 Deg.		54 Deg.		Diff.
	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	

Diff.	3½ Point		37 Deg.		38 Deg.		39 Deg.		3½ Points		40 Deg.		Diff.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	00.8	00.6	00.8	00.6	00.8	00.6	00.8	00.6	00.8	00.6	00.8	00.6	1
2	01.6	01.2	01.6	01.2	01.6	01.2	01.6	01.3	01.5	01.3	01.5	01.3	2
3	02.4	01.8	02.4	01.8	02.4	01.8	02.3	01.9	02.3	01.9	02.3	01.9	3
4	03.2	02.4	03.2	02.4	03.2	02.5	03.1	02.5	03.1	02.5	03.1	02.6	4
5	04.0	03.0	04.0	03.0	04.0	03.1	03.9	03.1	03.9	03.2	03.8	03.2	5
6	04.8	03.6	04.8	03.6	04.7	03.7	04.7	03.8	04.6	03.8	04.6	03.9	6
7	05.6	04.2	05.6	04.2	05.5	04.3	05.4	04.4	05.4	04.4	05.4	04.5	7
8	06.4	04.8	06.4	04.8	06.3	04.9	06.2	05.0	06.2	05.1	06.1	05.1	8
9	07.2	05.4	07.2	05.4	07.1	05.5	07.0	05.7	07.0	05.7	06.9	05.8	9
10	08.0	06.0	08.0	06.0	07.9	06.2	07.8	06.3	07.7	06.3	07.7	06.4	10
11	08.8	06.6	08.8	06.6	08.7	06.8	08.5	06.9	08.5	07.0	08.4	07.1	11
12	09.6	07.1	09.6	07.2	09.5	07.4	09.3	07.6	09.3	07.6	09.2	07.7	12
13	10.4	07.7	10.4	07.8	10.2	08.0	10.1	08.2	10.0	08.2	10.0	08.4	13
14	11.2	08.3	11.2	08.4	11.0	08.6	10.9	08.8	10.8	08.9	10.7	09.0	14
15	12.0	08.9	12.0	09.0	11.8	09.2	11.7	09.4	11.6	09.5	11.5	09.6	15
16	12.9	09.5	12.8	09.6	12.6	09.9	12.4	10.1	12.4	10.1	12.3	10.3	16
17	13.7	10.1	13.6	10.2	13.4	10.5	13.2	10.7	13.1	10.8	13.0	10.9	17
18	14.5	10.7	14.4	10.8	14.2	11.1	14.0	11.3	13.9	11.4	13.8	11.6	18
19	15.3	11.3	15.2	11.4	15.0	11.7	14.8	12.0	14.7	12.1	14.6	12.2	19
20	16.1	11.9	16.0	12.0	15.8	12.3	15.5	12.6	15.5	12.7	15.3	12.9	20
21	16.9	12.5	16.8	12.6	16.5	12.9	16.3	13.2	16.2	13.3	16.1	13.5	21
22	17.7	13.1	17.6	13.2	17.3	13.5	17.1	13.8	17.0	14.0	16.9	14.1	22
23	18.5	13.7	18.4	13.8	18.1	14.2	17.9	14.5	17.8	14.6	17.6	14.8	23
24	19.3	14.3	19.2	14.4	18.9	14.8	18.7	15.1	18.6	15.2	18.4	15.4	24
25	20.1	14.9	20.0	15.0	19.7	15.4	19.4	15.7	19.3	15.9	19.1	16.1	25
26	20.9	15.5	20.8	15.6	20.5	16.0	20.2	16.4	20.1	16.5	19.9	16.7	26
27	21.7	16.1	21.6	16.2	21.3	16.6	21.0	17.0	20.9	17.1	20.7	17.4	27
28	22.5	16.7	22.4	16.9	22.1	17.2	21.8	17.6	21.6	17.8	21.4	18.0	28
29	23.3	17.3	23.2	17.5	22.9	17.9	22.5	18.2	22.4	18.4	22.2	18.6	29
30	24.1	17.9	24.0	18.1	23.6	18.5	23.3	18.9	23.2	19.0	23.0	19.3	30
31	24.9	18.5	24.8	18.7	24.4	19.1	24.1	19.5	24.0	19.7	23.7	19.9	31
32	25.7	19.1	25.6	19.3	25.2	19.7	24.9	20.1	24.7	20.3	24.5	20.6	32
33	26.5	19.7	26.4	19.9	26.0	20.3	25.6	10.8	25.5	20.9	25.3	21.2	33
34	27.3	20.3	27.2	20.5	26.8	20.9	26.4	21.4	26.3	21.6	26.0	21.9	34
35	28.1	20.9	28.0	21.1	27.6	21.5	27.2	22.0	27.1	22.2	26.8	22.5	35
36	28.9	21.4	28.7	21.7	28.4	22.2	28.0	22.7	27.8	22.8	27.6	23.1	36
37	29.7	22.0	29.5	22.3	29.2	22.8	28.8	23.3	28.6	23.5	28.3	23.8	37
38	30.5	22.6	30.3	22.9	29.9	23.4	29.5	23.9	29.4	24.1	29.1	24.4	38
39	31.3	23.2	31.1	23.5	30.7	24.0	30.3	24.5	30.1	24.7	29.9	25.1	39
40	32.1	23.8	31.9	24.1	31.5	24.6	31.1	25.2	30.9	25.4	30.6	25.7	40
41	32.9	24.4	32.7	24.7	32.3	25.2	31.9	26.8	31.7	26.0	31.4	26.4	41
42	33.7	25.0	33.5	25.3	33.1	25.9	32.6	26.4	32.5	26.6	32.2	27.0	42
43	34.5	25.6	34.3	25.9	33.9	26.5	33.4	27.1	33.2	27.3	32.9	27.6	43
44	35.3	26.2	35.1	26.5	34.7	27.1	34.2	27.7	34.0	27.9	33.7	28.3	44
45	36.1	26.8	35.9	27.1	35.5	27.7	35.0	28.3	34.8	28.5	34.5	28.9	45
46	36.9	27.4	36.7	27.7	36.2	28.3	35.7	28.9	35.6	29.2	35.2	29.6	46
47	37.7	28.0	37.5	28.3	37.0	28.9	36.5	29.6	36.3	29.8	36.0	30.2	47
48	38.6	28.5	38.3	28.9	37.8	29.6	37.3	30.2	37.1	30.4	36.8	30.8	48
49	39.4	29.2	39.1	29.5	38.6	30.2	38.1	30.8	37.9	31.1	37.5	31.5	49
50	40.2	29.8	39.9	30.1	39.4	30.8	38.9	31.5	38.6	31.7	38.3	32.1	50
Diff.	4½ Point		53 Deg.		52 Deg.		51 Deg.		4½ Points		50 Deg.		Diff.

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Diff.	3½ Point		37 Deg.		38 Deg.		39 Deg.		3½ Point		40 Deg.		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
51	41.0	30.4	40.7	30.7	40.2	31.4	39.9	32.1	39.4	32.4	39.1	32.8	51
52	41.8	31.0	41.5	31.3	41.0	32.0	40.4	32.7	40.2	33.0	39.8	33.4	52
53	42.6	31.6	42.3	31.9	41.8	32.6	41.2	33.4	41.0	33.6	40.6	34.1	53
54	43.4	32.2	43.1	32.5	42.5	33.2	42.0	34.0	41.7	34.2	41.4	34.7	54
55	44.2	32.8	43.9	33.1	43.3	33.9	42.7	34.6	42.5	34.9	42.1	35.3	55
56	45.0	33.4	44.7	33.7	44.1	34.5	43.5	35.2	43.3	35.5	42.9	36.0	56
57	45.8	34.0	45.5	34.3	44.9	35.1	44.3	35.9	44.1	36.1	43.7	36.6	57
58	46.6	34.6	46.3	34.9	45.7	35.7	45.1	36.5	44.8	36.8	44.4	37.3	58
59	47.4	35.1	47.1	35.5	46.5	36.3	45.8	37.1	45.6	37.4	45.2	37.9	59
60	48.2	35.7	47.9	36.1	47.3	36.9	46.6	37.8	46.4	38.0	46.0	38.6	60
61	49.0	36.3	48.7	36.7	48.1	37.6	47.4	38.4	47.2	38.7	46.7	39.2	61
62	49.8	36.9	49.5	37.3	48.9	38.2	48.2	39.0	47.9	39.3	47.5	39.9	62
63	50.6	37.5	50.3	37.9	49.6	38.8	49.0	39.6	48.7	40.0	48.3	40.5	63
64	51.4	38.1	51.1	38.5	50.4	39.4	49.7	40.3	49.5	40.6	49.0	41.1	64
65	52.2	38.7	51.9	39.1	51.2	40.0	50.5	40.9	50.2	41.2	49.8	41.8	65
66	53.0	39.3	52.7	39.7	52.0	40.7	51.3	41.5	51.0	41.9	50.6	42.4	66
67	53.8	39.9	53.5	40.3	52.8	41.3	52.1	42.2	51.8	42.5	51.3	43.1	67
68	54.6	40.5	54.3	40.9	53.6	41.9	52.8	42.8	52.6	43.1	52.1	43.7	68
69	55.4	41.1	55.1	41.5	54.4	42.5	53.6	43.4	53.3	43.8	52.9	44.4	69
70	56.2	41.7	55.9	42.1	55.2	43.1	54.4	44.1	54.1	44.4	53.6	45.0	70
71	57.0	42.3	56.7	42.7	55.9	43.7	55.2	44.7	54.9	45.0	54.4	45.6	71
72	57.8	42.9	57.5	43.3	56.7	44.3	56.0	45.3	55.7	45.7	55.2	46.3	72
73	58.6	43.5	58.3	43.9	57.5	44.9	56.7	45.9	56.4	46.3	55.9	46.9	73
74	59.4	44.1	59.1	44.5	58.3	45.5	57.5	46.6	57.2	46.9	56.7	47.6	74
75	60.2	44.7	59.9	45.1	59.1	46.2	58.3	47.2	58.0	47.6	57.4	48.2	75
76	61.0	45.3	60.7	45.7	59.9	46.8	59.1	47.8	58.7	48.2	58.2	48.9	76
77	61.8	45.9	61.5	46.3	60.7	47.4	59.8	48.5	59.5	48.8	59.0	49.5	77
78	62.6	46.5	62.3	46.9	61.5	48.0	60.6	49.1	60.3	49.5	59.7	50.1	78
79	63.5	47.1	63.1	47.5	62.3	48.6	61.4	49.7	61.1	50.1	60.5	50.8	79
80	64.2	47.7	63.9	48.1	63.0	49.3	62.2	50.3	61.8	50.7	61.3	51.4	80
81	65.1	48.3	64.7	48.7	63.8	49.9	62.9	51.0	62.6	51.4	62.0	52.1	81
82	65.9	48.8	65.5	49.3	64.6	50.5	63.7	51.6	63.4	52.0	62.8	52.7	82
83	66.7	49.4	66.3	49.9	65.4	51.1	64.5	52.2	64.2	52.7	63.6	53.4	83
84	67.5	50.0	67.1	50.6	66.2	51.7	65.3	52.9	64.9	53.3	64.3	54.0	84
85	68.3	50.6	67.9	51.2	67.0	52.3	66.1	53.5	65.7	53.9	65.1	54.6	85
86	69.1	51.2	68.7	51.8	67.8	52.9	66.8	54.1	66.5	54.6	65.9	55.3	86
87	69.9	51.8	69.5	52.4	68.5	53.6	67.6	54.7	67.2	55.2	66.6	55.9	87
88	70.7	52.4	70.3	53.0	69.3	54.2	68.4	55.4	68.0	55.8	67.4	56.6	88
89	71.5	53.0	71.1	53.6	70.1	54.8	69.2	56.0	68.8	56.5	68.2	57.2	89
90	72.3	53.6	71.9	54.2	70.9	55.4	69.9	56.6	69.6	57.1	68.9	57.9	90
91	73.1	54.2	72.7	54.8	71.7	56.0	70.7	57.3	70.3	57.7	69.7	58.5	91
92	73.9	54.8	73.5	55.4	72.5	56.6	71.5	57.9	71.1	58.3	70.5	59.1	92
93	74.7	55.4	74.3	56.0	73.3	57.3	72.3	58.5	71.9	59.0	71.2	59.8	93
94	75.5	56.0	75.1	56.6	74.1	57.9	73.0	59.2	72.6	59.6	72.0	60.4	94
95	76.3	56.6	75.9	57.2	74.9	58.5	73.8	59.8	73.4	60.3	72.8	61.1	95
96	77.1	57.2	76.7	57.8	75.6	59.1	74.6	60.4	74.2	60.9	73.5	61.7	96
97	77.9	57.8	77.5	58.4	76.4	59.7	75.4	61.0	75.0	61.5	74.3	62.4	97
98	78.7	58.4	78.3	59.0	77.2	60.3	76.2	61.7	75.8	62.2	75.1	63.0	98
99	79.5	59.0	79.1	59.6	78.0	61.0	76.9	62.3	76.5	62.8	75.8	63.6	99
100	80.3	59.6	79.9	60.2	78.8	61.6	77.7	62.9	77.3	63.4	76.6	64.3	100
Diff.	4½ Point		53 Deg.		52 Deg.		51 Deg.		4½ Point		50 Deg.		Diff.
	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	

Diff.	41 Deg.		42 Deg.		3 $\frac{1}{2}$ Point		43 Deg.		44 Deg.		4 Points		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
1	00.8	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	00.7	1
2	01.5	01.3	01.3	01.3	01.5	01.3	01.5	01.4	01.4	01.4	01.4	01.4	2
3	02.3	02.0	02.2	02.0	02.2	02.0	02.2	02.0	02.2	02.1	02.1	02.1	3
4	03.0	02.6	03.0	02.7	03.0	02.7	03.0	02.7	02.9	02.8	02.8	02.8	4
5	03.8	03.3	03.7	03.3	03.7	03.4	03.7	03.4	03.6	03.5	03.5	03.5	5
6	04.5	03.9	04.5	04.0	04.4	04.0	04.4	04.1	04.3	04.2	04.2	04.2	6
7	05.3	04.6	05.2	04.7	05.2	04.7	05.1	04.8	05.0	04.9	04.9	04.9	7
8	06.0	05.2	05.9	05.4	05.9	05.4	05.9	05.5	05.8	05.6	05.7	05.7	8
9	06.8	05.9	06.7	06.0	06.7	06.0	06.6	06.2	06.5	06.3	06.4	06.4	9
10	07.5	06.6	07.4	06.7	07.4	06.7	07.3	06.8	07.2	06.9	07.1	07.1	10
11	08.3	07.2	08.2	07.4	08.1	07.4	08.0	07.5	07.9	07.6	07.8	07.8	11
12	09.1	07.9	08.9	08.0	08.9	08.1	08.8	08.2	08.6	08.3	08.5	08.5	12
13	09.8	08.5	09.7	08.7	09.6	08.7	09.5	08.9	09.4	09.0	09.2	09.2	13
14	10.6	09.2	10.4	09.4	10.4	09.4	10.2	09.5	10.1	09.7	09.9	09.9	14
15	11.3	09.8	11.1	10.0	11.1	10.1	11.0	10.2	10.8	10.4	10.6	10.6	15
16	12.1	10.5	11.9	10.7	11.9	10.7	11.7	10.9	11.5	11.1	11.3	11.3	16
17	12.8	11.2	11.6	11.4	12.6	11.4	12.4	11.6	12.2	11.8	12.0	12.0	17
18	13.6	11.8	13.4	12.0	13.3	12.1	13.2	12.3	12.9	12.5	12.7	12.7	18
19	14.3	12.5	14.1	12.7	14.1	12.8	13.9	13.0	13.7	13.2	13.4	13.4	19
20	15.1	13.1	14.9	13.4	14.8	13.4	14.6	13.6	14.4	13.9	14.1	14.1	20
21	15.8	13.8	15.6	14.0	15.6	14.1	15.4	14.3	15.1	14.6	14.8	14.8	21
22	16.6	14.4	16.3	14.7	16.3	14.8	16.1	15.0	15.8	15.3	15.6	15.6	22
23	17.4	15.1	17.1	15.4	17.0	15.4	16.8	15.7	16.5	16.0	16.3	16.3	23
24	18.1	15.7	17.8	16.1	17.8	16.1	17.6	16.4	17.3	16.7	17.0	17.0	24
25	18.9	16.4	18.6	16.7	18.5	16.8	18.3	17.1	18.0	17.4	17.7	17.7	25
26	19.4	17.1	19.3	17.4	19.3	17.6	19.0	17.7	18.7	18.1	18.4	18.4	26
27	20.4	17.7	20.1	18.1	20.0	18.1	19.7	18.4	19.4	18.8	19.1	19.1	27
28	21.1	18.4	20.8	18.7	20.7	18.8	20.5	19.1	20.1	19.5	19.8	19.8	28
29	21.9	19.0	21.5	19.4	21.5	19.5	21.2	19.8	20.9	20.1	20.5	20.5	29
30	22.6	19.7	22.3	20.1	22.2	20.1	21.9	20.5	21.6	20.8	21.2	21.2	30
31	23.4	20.3	23.0	20.7	23.0	20.8	22.7	21.2	22.3	21.5	21.9	21.9	31
32	24.2	21.0	23.8	21.4	23.7	21.5	23.4	21.8	23.0	22.2	22.6	22.6	32
33	24.9	21.4	24.5	22.1	24.6	22.2	24.1	22.5	23.7	22.9	23.3	23.3	33
34	25.7	22.3	25.3	22.7	25.2	22.8	24.9	23.2	24.5	23.6	24.0	24.0	34
35	26.4	23.0	26.0	23.4	25.9	23.5	25.6	23.9	25.2	24.3	24.7	24.7	35
36	27.2	23.6	26.7	24.1	26.7	24.2	26.3	24.6	25.9	25.0	25.5	25.5	36
37	27.9	24.3	27.5	24.8	27.4	24.8	27.0	25.2	26.6	25.7	26.2	26.2	37
38	28.7	24.9	28.2	25.4	28.2	25.5	27.8	25.9	27.3	26.4	26.9	26.9	38
39	29.4	25.6	29.0	26.1	28.9	26.2	28.5	26.6	28.1	27.1	27.6	27.6	39
40	30.2	26.2	29.7	26.8	29.6	26.9	29.3	27.3	28.8	27.8	28.3	28.3	40
41	30.9	26.9	30.5	27.4	30.4	27.5	30.0	28.0	29.5	28.5	29.0	29.0	41
42	31.7	27.6	31.2	28.1	31.1	28.2	30.7	28.6	30.2	29.2	29.7	29.7	42
43	32.5	28.2	32.0	28.8	31.9	28.9	31.4	29.3	30.9	29.9	30.4	30.4	43
44	33.2	28.9	32.7	29.4	32.6	29.5	32.2	30.0	31.6	30.6	31.1	31.1	44
45	34.0	29.5	33.4	30.1	33.3	30.2	32.9	30.7	32.4	31.3	31.8	31.8	45
46	34.7	30.2	34.2	30.8	34.1	30.9	33.6	31.4	33.1	32.0	32.5	32.5	46
47	35.5	30.8	34.9	31.4	34.8	31.6	34.4	32.1	33.8	32.6	33.2	33.2	47
48	36.2	31.5	35.7	32.1	35.6	32.2	35.1	32.7	34.5	33.8	33.9	33.9	48
49	37.0	32.1	36.4	32.8	36.3	32.9	35.8	33.4	35.2	34.0	34.6	34.6	49
50	37.7	32.8	37.1	33.5	37.0	33.6	36.6	34.1	36.0	34.7	35.4	35.4	50
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	49 Deg.	48 Deg.			4 $\frac{1}{2}$ Point			47 Deg.	46 Deg.		4 Points		

Diff.	41 Deg.		42 Deg.		3 $\frac{1}{4}$ Point		43 Deg.		44 Deg.		4 Points		Diff.
	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	
51	38.5	33.5	37.9	34.1	37.8	34.3	37.3	34.8	36.7	35.4	36.1	36.1	51
52	39.2	34.1	38.6	34.8	38.5	34.9	38.0	35.5	37.4	36.1	36.8	36.8	52
53	40.0	34.8	39.4	35.5	39.3	35.6	38.8	36.2	38.1	36.8	37.5	37.5	53
54	40.8	35.4	40.1	36.1	40.0	36.3	39.5	36.8	38.8	37.5	38.2	38.2	54
55	41.5	36.1	40.9	36.8	40.8	36.9	40.2	37.5	39.6	38.2	38.9	38.9	55
56	42.3	36.7	41.6	37.5	41.5	37.6	41.0	38.2	40.3	38.9	39.6	39.6	56
57	43.0	37.4	42.3	38.1	42.2	38.3	41.7	38.9	41.0	39.6	40.3	40.3	57
58	43.8	38.0	43.1	38.8	43.0	39.0	42.4	39.6	41.7	40.3	41.0	41.0	58
59	44.5	38.7	43.8	39.5	43.7	39.6	43.1	40.2	42.4	41.0	41.7	41.7	59
60	45.3	39.4	44.6	40.1	44.5	40.3	43.9	40.9	43.2	41.7	42.4	42.4	60
61	46.0	40.0	45.3	40.8	45.2	41.0	44.6	41.6	43.9	42.4	43.1	43.1	61
62	46.8	40.7	46.1	41.5	45.9	41.6	45.3	42.3	44.6	43.1	43.8	43.8	62
63	47.5	41.3	46.8	42.1	46.7	42.3	46.1	43.0	45.3	43.8	44.5	44.5	63
64	48.3	42.0	47.5	42.8	47.4	43.0	46.8	43.6	46.0	44.5	45.3	45.3	64
65	49.1	42.6	48.3	43.5	48.2	43.7	47.5	44.3	46.8	45.2	46.0	46.0	65
66	49.8	43.3	49.0	44.2	48.9	44.3	48.3	45.0	47.5	45.8	46.7	46.7	66
67	50.6	44.0	49.8	44.8	49.6	45.0	49.0	45.7	48.2	46.5	47.4	47.4	67
68	51.3	44.6	50.5	45.5	50.4	45.7	49.7	46.4	48.9	47.2	48.1	48.1	68
69	52.1	45.3	51.3	46.2	51.1	46.3	50.5	47.1	49.6	47.9	48.8	48.8	69
70	52.8	45.9	52.0	46.8	51.9	47.0	51.2	47.7	50.4	48.6	49.5	49.5	70
71	53.6	46.6	52.8	47.5	52.6	47.7	51.9	48.4	51.1	49.3	50.2	50.2	71
72	54.3	47.2	53.5	48.2	53.4	48.4	52.7	49.1	51.8	50.0	50.9	50.9	72
73	55.1	47.9	54.2	48.8	54.1	49.0	53.4	49.8	52.5	50.7	51.6	51.6	73
74	55.8	48.5	55.0	49.5	54.8	49.7	54.1	50.5	53.2	51.4	52.3	52.3	74
75	56.6	49.2	55.7	50.2	55.6	50.4	54.9	51.2	53.9	52.1	53.0	53.0	75
76	57.4	49.9	56.5	50.8	56.3	51.0	55.6	51.8	54.7	52.8	53.7	53.7	76
77	58.1	50.5	57.2	51.5	57.1	51.7	56.3	52.5	55.4	53.5	54.4	54.4	77
78	58.9	51.2	58.0	52.2	57.8	52.4	57.0	53.2	56.1	54.2	55.2	55.2	78
79	59.6	51.8	58.7	52.9	58.5	53.1	57.8	53.9	56.8	54.9	55.9	55.9	79
80	60.4	52.5	59.4	53.5	59.3	53.7	58.5	54.6	57.5	55.6	56.6	56.6	80
81	61.1	53.1	60.2	54.2	60.0	54.4	59.2	55.2	58.3	56.3	57.3	57.3	81
82	61.9	53.8	60.9	54.9	60.8	55.1	60.0	55.9	59.0	57.0	58.0	58.0	82
83	62.6	54.4	61.7	55.5	61.5	55.7	60.7	56.6	59.7	57.7	58.7	58.7	83
84	63.4	55.1	62.4	56.2	62.2	56.4	61.4	57.3	60.4	58.3	59.4	59.4	84
85	64.2	55.8	63.2	56.9	63.0	57.1	62.2	58.0	61.1	59.0	60.1	60.1	85
86	64.9	56.4	63.9	57.5	63.7	57.8	62.9	58.6	61.9	59.7	60.8	60.8	86
87	65.7	57.1	64.6	58.2	64.5	58.4	63.6	59.3	62.6	60.4	61.5	61.5	87
88	66.4	57.7	65.4	58.9	65.2	59.1	64.4	60.0	63.3	61.1	62.2	62.2	88
89	67.2	58.4	66.1	59.6	65.9	59.8	65.1	60.7	64.0	61.8	62.9	62.9	89
90	67.9	59.0	66.9	60.2	66.7	60.4	65.8	61.4	64.7	62.5	63.6	63.6	90
91	68.7	59.7	67.6	60.9	67.4	61.1	66.6	62.1	65.5	63.2	64.3	64.3	91
92	69.4	60.4	68.4	61.6	68.2	61.8	67.3	62.7	66.2	63.9	65.1	65.1	92
93	70.2	61.0	69.1	62.2	68.9	62.4	68.0	63.4	66.9	64.6	65.8	65.8	93
94	70.9	61.7	69.9	62.9	69.7	63.1	68.7	64.1	67.6	65.3	66.5	66.5	94
95	71.7	62.3	70.6	63.6	70.4	63.8	69.5	64.8	68.3	66.0	67.2	67.2	95
96	72.5	63.0	71.3	64.2	71.1	64.5	70.2	65.5	69.1	66.7	67.9	67.9	96
97	73.2	63.6	72.1	64.9	71.9	65.1	70.9	66.2	69.8	67.4	68.6	68.6	97
98	74.0	64.3	72.8	65.6	72.6	65.8	71.7	66.8	70.5	68.1	69.3	69.3	98
99	74.7	65.0	73.6	66.2	73.4	66.5	72.4	67.5	71.2	68.8	70.0	70.0	99
100	75.5	65.6	74.3	66.9	74.1	67.2	73.1	68.2	71.9	69.5	70.7	70.7	100
Diff.	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Dep	Lat	Diff.
	49 Deg.		48 Deg.		4 $\frac{1}{4}$ Point		47 Deg.		46 Deg.		4 Points		

The Use and Explanation of the Table of Difference of Latitude and Departure.

THIS Table gives the Difference of Latitude and Departure in Minutes and Tenths, to any Distance not exceeding 100 Miles, and to every Degree and Quarter Point of the Compass; and may be used to a greater Distance being taken out at twice or thrice, according to the Quantity of the Distance, as shall be shewn in the Use.

The Course stands at the Head and Foot of the Table, to every Degree and Quarter Point of the Compass; at the Head it begins at 1 deg. to 2 deg. $\frac{1}{4}$ Point, &c. encreasing to 45 deg. or 4 Points. At the Foot it begins at 45 deg. or 4 Points, to 46 deg. 47 deg. $4\frac{1}{4}$ Points, &c. encreasing backwards to 90 deg. or 8 Points. The Distance stands in the two outmost Columns under the Title *Dist.* which on the Left-hand Page begins at 1 and runs to 50; on the Right-hand Page it begins at 51, and runs to 100, the Difference of Latitude and Departure stands under the Course at the Head, and over it at the Foot of the Table.

The Use of the TABLE.

This Table is very useful in Navigation, especially in working a *Traverse*.

Example 1. The Course and Distance given, to find the Difference of Latitude and Departure by the Table.

Suppose a Ship sails NNE. 3 quarters E. 95 Miles, the Difference of Latitude and Departure are required.

On the Right-hand Page (because the Distance is above 50) and at the Top (because it is less than 4 Points) look for $2\frac{3}{4}$ Points, which is the Course; under which, and against 95 the Distance, and under the Title *Lat.* stands 81.5, which is 81 min. $\frac{5}{10}$ the Difference of Latitude, and under the Title *Dep.* stands 48.8, which is 48 min. $\frac{8}{10}$ the Departure required?

Example 2. Suppose a Ship sails South 56 deg. Westerly 48 Miles, the Difference of Latitude and Departure required?

On the Left-hand Page (because the Distance is less than 50) and at the Bottom (because it is more than 45d.) look for 56d. the Course; over which, and against 48 the Distance, over the Title *Lat.* stands 26.8, that is 26 min. $\frac{8}{10}$ the Difference of Latitude; and over the Title *Dep.* stands 39.8, that is 39 min. $\frac{8}{10}$ the Departure required?

Example 3. Suppose a Ship sails North West by North 160 Miles, the Difference of Latitude and Departure are required by the Table?

On the Right-hand Page at the Top, look for 3 Points the Course. Now because the Table goes to but 100, take for 100 first; therefore under 3 Points, and against 100, under the Title *Lat.* stands 83.1, that is 83 min. $\frac{1}{10}$ the Difference of Latitude; and under the Title *Dep.* stands 55.6 that

that is 55 min. 6 tenths the Departure; then for 60 under 3 Points, against 60 under the Title *Lat.* stands 49.9, that is 49 min. 9 tenths the Difference of Latitude, and under the Title *Dep.* stands 33.3 that is 33 min. 3 tenths the Departure, then add the Difference of Latitude and Departure for 60, to the Difference of Latitude and Departure for 100, the Sum is 133 min. the Difference of Latitude, and 88.9 tenths, the Departure required.

This Table is also useful in the Resolution of the rest of the Problems of *Plane Sailing*, which for Brevity-sake are omitted here, being taught at large in the last Edition of *Practical Navigation*; but the general Use of it is in the exact Working of a Traverse.

Example 1. Suppose a Ship bound to a certain Port, sails S. E. by S. 49 min. then ESE. half E. 52 min. then E. by N. half E. 62 min. then SSW. half W. 57 min. then S. half E. 39 min. to find the Difference of Latitude and Departure the Ship hath made.

Set down the several Courses and Distances, first allowing for Lee-way, if any; then proceed to look out the Difference of Latitude and Departure for each Course and Distance (by the Directions before given) in the Table, placing them in their proper Columns, (*viz*) If the Course be Northerly, the Difference of Latitude must be put in the North Column, if Southerly in the South Column; if the Departure be Easterly it must be put in the East Column; if Westerly in the West Column, as was before directed: Then having framed the Table, add up the Columns of Difference of Latitude and Departure, and subtract the lesser Difference of Latitude and Departure from the greater, the Remainder is the general Difference of Latitude and Departure.

The TABLE.

Courses.	Distances	Diff. of Lat.		Departure	
		North	South	East	West
S. E. by S.	49		40.7	27.2	
ESE. half E.	52		15.1	49.7	
E. by N. $\frac{1}{2}$ E.	62	06.1		61.7	
S.S.W. $\frac{1}{2}$ W.	57		50.3		26.9
S. half E.	39		38.8	03.8	
		06.1	144.9	142.5	26.9
			06.1	26.9	
			138.8	115.6	

The general Diff. of Lat. is 138.8 tenths S. the Dep. 115.5 tenths E. then to find the Course and Distance, find the Lat. and Dep. in their proper Columns, but the Tables not extending so far, I take half of each, *viz* half the Diff. of Lat. 69.4. and half the Dep. 57.8, the nearest to which, in the Columns of Lat. and Dep. in the Traverse Table is 69.6 and 57.1, over which at the Top I find $3\frac{1}{2}$ Points for the Course South Easterly, or South East half South, and in the Co-

lumn of Dist. 90, which doubled (because I took half the two Numbers) is 180 the Distance required.

Example

Example 2. The Course given in Degrees, which often happens, by reason of Allowance for the Variation of the Compass, and in the like Cases.

Suppose a Ship bound to a certain Port, sails 65 Miles North, 34 deg. Westerly. Then 56 Miles North, 67 deg. Westerly. Then 48 Miles South 78 deg. Westerly. Then 54 Miles North, 23 deg. Easterly. Then 36 Miles North, 6 deg. Easterly, the Difference of Latitude and Departure are required

The T A B L E

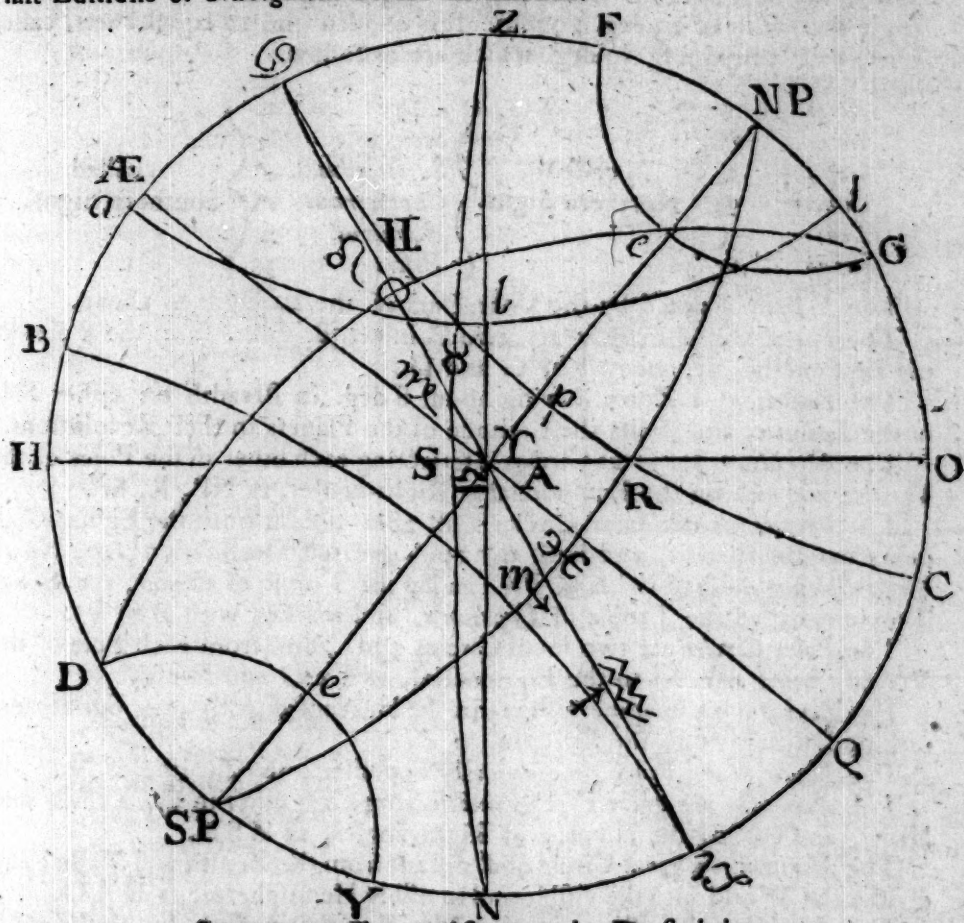
Courses.		Distance.	Diff. of Latitude		Departure	
			North.	South	East	West
NW	34°	65	53.9			36.3
NW	67°	56	21.9			51.5
SW	78°	48		10.0		47.0
NE	23°	54	49.7		21.1	
NE	6°	36	35.8		03.8	
			161.3	10.0	24.9	134.8
			10.0			24.9
			151.3			109.9

The general Difference of Latitude is 151.3 North, the Departure 109.9 West. The Course and Distance is found as in the last Example.

But if you would keep a Reckoning both in Latitude and Longitude, you may also find the Difference of Longitude by the *Traverse Table* (according to *Middle Latitude Sailing*) thus, find the Complement of Middle Latitude in the Degrees, at the Top or Bottom of the Table, and under or above that in the Column of Departure, find your Departure, and right against that, in the Column of Distance, you have the Difference of Longitude; if your Departure is too large for the Table, take one-half, or one-third thereof, and proceed as before.

Example. Suppose in the last Instance of a *Traverse*, the Ship hath sailed from Latitude 50. degrees 0 min. North, then, because the Difference of Latitude is 151 min. or 2 deg. 31 min. the Latitude come to is 52 deg. 31 min. and consequently the Middle Latitude is 51 deg. 16 min. which being nearest 51 deg. I look for 51 at the Head of the Table, and under it in the Column of Lat. I look for the Departure 110, but the Table not proceeding so far, I take it's half, viz. 55, the nearest to which in the Table, is, 54.7 (being less) against which, in the Column of Distance is 87, which doubled (because I took half the Departure) the Sum 174 min. or 2d. 54 min. is the Difference of

Longitude required, which is sufficiently exact for common Practice, only I would advise all Persons for avoiding as much as possible any Error, that every Time the Reckoning is corrected by an Observation, the Longitude be also corrected according to *Mercator's Sailing*, as you are taught in the last Editions of *Navigation* before-mentioned.



Some necessary Astronomic Definitions.

THE Poles of the Equinoctial (commonly called the Poles of the World) are two fixed Points in the Heavens, opposite one to the other; the one visible to us, called the North Pole, marked with the Letters N. P; the other not visible to us, called the South Pole, marked with S. P.

The *Axis* of the World is a Line imagined to pass from Pole to Pole about which is performed the diurnal Revolution, as the Line NP, A, SP.

F

The

The *Equinoctial* is a great Circle 90 deg. distant from the Poles of the World, and divides the Globe into the North and South Hemispheres; it is noted by the Letters *Æ A Q*.

The *Ecliptic* is a great Circle intersecting the Equinoctial in two opposite Points, the beginning of *Aries*, and the beginning of *Libra*, and makes an Angle therewith of 23 deg. 29 min. It is divided into 12 equal Parts, called Signs, each containing 30 deg. which are as follow.

<i>Aries</i>	♈	called Northern Signs.	<i>Libra</i>	♎	called Southern Signs.
<i>Taurus</i>	♉		<i>Scorpio</i>	♏	
<i>Gemini</i>	♊		<i>Sagittarius</i>	♐	
<i>Cancer</i>	♋		<i>Capricornus</i>	♑	
<i>Leo</i>	♌		<i>Aquarius</i>	♒	
<i>Virgo</i>	♍		<i>Pisces</i>	♓	

The *Ecliptic* is noted by the Characters of the 12 Signs as above.

The Poles of the *Ecliptic* are two Points 23d. 28m. from the Poles of the Equinoctial, represented by G and D.

The *Zodiac* is a Zone, having about 8 deg. in Breadth on either Side of the Ecliptic, and limits the Latitude of the Planets in their Revolutions.

The *Meridians* are great Circles intersecting each other in the Poles of the World, and cutting the Equinoctial at Right-angles, as NP, R, SP.

The *Tropics* are two small Circles 23d. 28m. distant from the Equinoctial, being parallel thereto, and limit the Sun's greatest Declination; the North Tropic being marked with ♋ P C, called the Tropic of *Cancer*, the South Tropic is called the Tropic of *Capricorn*, and marked with ♑ B m vs.

The *Polar Circles* are two small Circles 23d. 28m. from each Pole of the World, being parallel to the Equinoctial, as F e G and D e Y.

The *Zenith* is an imaginary Point in the Heavens directly over our Heads, viz. god. distant from the Horizon, as Z.

The *Nadir* is the Point diametrically opposite to the Zenith, as N.

The *Azimuths* are great Circles intersecting each other in the Zenith and Nadir, and cutting the Horizon at Right-angles, as Z S N.

The *Horizon* is a great Circle 90d. distant from the Zenith and Nadir, and divides the World into the visible and invisible Hemispheres, as H A O.

The *Meridian* of a Place, is that Meridian that passeth by the Zenith and the Nadir, of the said Place, and is represented by the Circle ZOQNHZ.

Parallels of Altitude or *Almicanters*, are small Circles parallel to the Horizon; imagined to pass through any Degree of Altitude, between the Horizon and the Zenith, as *alt*.

Parallels of Declination or *Latitude*, are small Circles parallel to the Equinoctial, and are called *Parallels of Declination*, with respect to the Heavens, and *Parallels of Latitude* respecting the Earth, as ♋ p R C.

Circles

Circles of the Longitude in the Heavens, are great Circles intersecting each other in the Poles of the Ecliptic, and cutting the Ecliptic at Right Angles, as G, O, D.

Parallels of Latitude in the Heavens, are small Circles parallel to the Ecliptic.

The *Latitude* of a Star is an Arch of a Circle of Longitude contained between the Center of the Star and the Ecliptic, and is accounted either Northerly or Southerly,

The *Longitude* of a Star is an Arch of the Ecliptic, intercepted between a Circle of Longitude passing by the Star, and the beginning of *Aries*, and is accounted according to the Order of the Signs.

The *Declination* of the Sun or Star is an Arch of the Meridian contained between the Center of the Sun or Star, and the Equinoctial, and is accounted either Northerly or Southerly.

The *Right Ascension* is that Degree and Minute of the Equinoctial that comes to the Meridian with the Center of the Sun or Star.

Oblique Ascension is the Degree and Minute of the Equinoctial that riseth with the Center of the Sun or Star, in an Oblique Sphere.

Oblique Descension is the Degree and Minute of the Equinoctial that sets with the Center of the Sun or Star, in an Oblique Sphere.

Ascensional Difference is an Arch of the Equinoctial, contained between the Right and Oblique Descension or Ascension, or it is the Difference of the Time between the Sun-rising or setting, and six o'Clock.

The *Amplitude* is an Arch of the Horizon, being the Distance of the Rising or Setting of the Sun or Star from the East or West, and is accounted either Northerly or Southerly.

The *Latitude* of a Place is the Height of the Pole above the Horizon, or the Distance between the Zenith and the Equinoctial.

Longitude on the Earth, is an Arch of the Equator contained between the Meridian of the Place where the Longitude is assigned to begin, and the Meridian of any other Place, and is accounted either Easterly or Westerly.

Astronomic Problems useful in NAVIGATION.

PROBLEM I.

THE Sun's Place and greatest Declination given, to find it's present Declination.

Example.

Suppose the Sun's Place to be 20d. 30m. in *Gemini*, the greatest Declination is 23d. 29m. it is required to find the present Declination.

The Operation by the Logarithms.

As Radius	_____	10.000000
Is to S. Sun's greatest Declination 23d. 29m.	_____	9.606409
So is S. Sun's Longitude 80d. 30m. from <i>Aries</i>	_____	9.994003
To S. Sun's present Declination 23d. 9m. North	_____	19.594412

By Gunter.

The Extent from Radius S. 90d. to S. 23d. 29m. will reach from S. 80d. 30m. to the S. 23d. 9m. the Sun's Declin. N. because in a Northern Sign.

Note, The Sun's Longitude is reckoned from the next Equinoctial Point; therefore if the Sun be in *Aries*, *Taurus*, *Gemini*, *Capricornus*, *Aquarius* or *Pisces*, the Longitude is accounted from *Aries*, but if in *Cancer*, *Leo*, *Virgo*, *Libra*, *Scorpio*, *Sagittarius*, it is accounted from *Libra*.

Aries, *Taurus*, *Gemini*, *Cancer*, *Leo*, *Virgo*, are called Northern Signs, *Libra*, *Scorpio*, *Sagittarius*, *Capricornus*, *Aquarius* and *Pisces*, are called Southern Signs. Consequently, if the Sun's Place be in any of the first six Signs, the Declination is North; but if in any of the latter six, the Declination is South.

P R O B. II.

The Sun's greatest Declin. and present Declin. given, to find his Place.

The Sun's greatest Declination is 23d. 29m. and present Declination is 18d. 30m. North increasing, the Sun's Place required?

By the Logarithms.

As the S. of the Sun's greatest Declination 23d. 29m. ——— 9.602409

To the Radius ——— 10.000000

So is the Sine of the present Declination 18d. 30m. North ——— 9.501476

To the Sine of the Sun's Longitude 52d. 46m. ——— 9.901067

That is one Sign (30d. making a Sign) and 22d. 46m. from *Aries*, because the Declination is North and increasing, that is 22d. 46m. of *Taurus*; but if the Declination had been North decreasing, it must have been accounted from *Libra*, and then it would have been 7d. 14m. in *Leo*.

By Gunter.

The Extent of the Compasses from the Sine 23d. 29m. the greatest Declination to Radius, S. 90d. will reach from S. 18d. 30m. the Sun's present Declination, to 52d. 46m. the Sun's Longitude as above.

P R O B. III.

The Sun's Place and greatest Declination given to find the Right Ascension.

Example.

The Sun's Place 10d. 30m. in *Aquarius*, the Right Ascension is required:

The Operation by the Logarithms.

As Radius ——— 10.000000

To the Tangent of the Sun's Longitude from *Aries* 49d. 30m. 10.668501

So is the S.c. of the greatest Declination 23d. 29m. ——— 9.962453

To the Tangent of the Sun's Right Ascension 47d. 02m. ——— 10.030954

By Gunter.

The Extent from Radius S. 90d. to S.c. of the greatest Declination 66d. 41m. will reach from Tangent Sun's Longitude from *Aries* 49d. 30m. to the Tangent of the Right Ascension 47d. 02m. required. *Note*

Note, This Proportion gives the Sun's Right Ascension from the next Equinoctial Point; but it ought to be accounted from *Aries* according to the Order and Succession of the Signs, and therefore in this Case 47d. 2m. subtracted from 360d. (because the Sun is in the 4th Quarter of the Ecliptic, or South decreasing) gives 312d. 58m. the Right Ascension from *Aries*.

P R O B. IV.

The Latitude of a Place, and the Sun's Declination given, to find the Sun's Amplitude.

Example.

The Latitude 51d. 32m. North, and the Sun's Declination 15d. 20m. North, what is the Amplitude?

The Operation by the Logarithms.

As S.c. of the Latitude 51d. 32m. —————	9.793832
To Radius —————	10.000000
So is the S. of the Declination 15d. 20m. North ———	9.422318
To the S. of the Sun's Amplitude 25d. 9m. —————	9.628486

By Gunter.

The Extent from the S. c. of the Latitude 38d. 28m. to the Sine of the Declination 15d. 20m. North, will reach from Radius S. 90d. to S. 25d. 9m. the Sun's Amplitude North, as above.

Note, If the Declination be North, the Amplitude is North, and if the Declination be South, the Amplitude is also South.

P R O B. V.

The Latitude of a Place, and the Sun's Declination given, to find the Ascensional Difference.

Example.

Suppose in the Latitude 51d. 32m. North, the Sun's Declination is 10d. 45m. North, and the Ascensional Difference required.

The Operation by the Logarithms.

As Tangent Complement of the Latitude 51d. 32m. ———	9.900086
To Radius —————	10.000000
So is the Tangent of the Sun's Declination 10d. 45m. ———	9.278424
To the Sine of the Ascensional Difference 13d. 49m. ———	9.378338

By Gunter.

The Extent from Tangent 38d. 28m. (the Complement of Latitude) to Tangent 10d. 45m. the Sun's Declination; will reach from Radius S. 90d. to S. 13d. 49m. the Sun's Ascensional Difference as above.

P R O B.

P R O B. VI.

To find the Oblique Ascension and Descension.

First, Find the Ascensional Difference by the Fifth Problem.

Secondly, The Right Ascension by the Third Problem.

When the Latitude and Sun's Declination are both North or both South, the Ascensional Difference subtracted from the Right Ascension, gives the Oblique Ascension, and added thereto, gives the Oblique Descension; but when one is North and the other South, the Ascensional Difference added to the Right Ascension, gives the Oblique Ascension, and subtracted gives the Oblique Descension.

Note, That if the Ascensional Difference exceed the Right Ascension, add to the Right Ascension 360 Degrees, then subtract the Ascensional Difference therefrom.

Or, if both being added together exceed 360 Degrees, the Excess is the Oblique Ascension or Descension.

P R O B. VII.

To find the Time of the Sun's Rising and Setting, and Length of the Day or Night.

Find the Ascensional Difference by the Fifth Problem, which convert into Hours and Minutes of Time, accounting for 15 Degrees of the Equinoctial one Hour, and for every Degree 4 Minutes of Time, and for every 15 Minutes of the Equinoctial 1 Minute of Time.

1. If the Latitude and Sun's Declination are both North or both South, the Ascensional Difference added to six Hours, gives the Time of Sun-setting; and subtracted is the Time of Sun-rising.

2. But if one be North and the other South, then the Ascensional Difference added, gives the Time of Sun-rising; and subtracted is the Time of setting.

The Time of Sun-setting doubled, gives the Length of the Day; the Time of Sun-rising doubled, is the Length of the Night.

Example.

In Latitude 51d. 32m. North, suppose the Sun's Declination 21d. 57m. North, the Ascensional Difference is 30d. 29m. which reduced in Time is

H. M. S.

2 1 56
6 0 0

H. M. S.

Sun setteth — 8 1 56
Sun riseth — 3 58 4

doubled is { 16 3 52 } length of the { Day.
7 56 8 } Night.

P R O B

P R O B. VIII.

The Latitude of a Place, the Sun's Altitude and Declination given, to find the Azimuth.

The R U L E.

Take the Complement of the Altitude, the Compl. of the Latitude, and the Compl. of the Declination, add them together, and take the half Sum; subtract the Compl. of the Declination from the half Sum, and take the Remainder; then set down the Compl. Arithmetical of the Sines of the Compl. Altitude, and Compl. Latitude, and thereto add the Sines of the half Sum and Remainder; half the Sum of these four Logarithms is the S.c. of half the Azimuth required.

Note, If the Declination be South in North Latitude, or North in South Latitude, instead of taking the Complement of the Declination to 90d. you must add 90 Degrees thereto, and then proceed as before.

Example 1.

In the Latitude 51d. 32m. North, the Sun's Declination is 20d. 30m. North, his Altitude 47d. 30m. and his Azimuth from the North required.

The Operation by the Logarithms.

d.	m.			
42	: 30	Compl. Altitude A.M.	————	S. Co. Ar. — 0.170317
38	: 28	Compl. Latitude North	————	S. Co. Ar. — 0.206168
69	: 30	Compl. Declination N. or Sun's Distance from the Pole.		
150	: 28	Sum		
75	: 14	Half Sum	————	S. — 9.985414
5	: 44	Excess of the Half Sum above c. Decl.	S. —	8.999559
				Sum 19.361458
61d.	: 21m.	Sc.	————	Half Sum 9.680729
61d.	: 21m.			

doubled 122d. : 42m. the Sun's Azimuth from the North required.

The Operation by Gunter's Scale

The Extent of the Compasses from Radius S. 90d. to S. 42d. 30m. the Complement of the Altitude, will reach from S. 38d. 28m. the Complement of the Latitude, to Sine 24d. 40m. then the Extent from Sine 24d. 40m. to Sine 75d. 14m. the half Sum, will reach from S. 5d. 44m. (the Excess of the half Sum, above the Complement Declination) to 122d. 42m. (upon the Line of versed Sines) which is the Azimuth required.

Example

Example 2. In the Latitude of 51d. 32m. North, the Sun's Declination is 18d. 15m. South, his Altitude 17d. 45m. and the Azimuth from the North required?

The Operation by the Logarithms.

d.	m.				
72	: 15	Compl. Altitude	_____	S. Co. Ar.	0.021183
38	: 28	Compl. Latitude	_____	S. Co. Ar.	0.206168
108	: 15	Declination 90 Degrees being added, because South.			
218	: 58	Sum			
109	: 29	Half Sum supp. to 180d. is 70d. 31m.	S:	_____	9.974391
1	: 14	Remainder	_____	S.	8.332920
		d.	m.		Sum 18.534666
		79	: 20	— S.c. —	half Sum — 9.267333
		79	: 20		

Which doubled is 158 : 40 the Azimuth from the North required.

By Gunter.

The Extent from Radius S. 90d. to the S. 72d. 15m. the Comp. Altitude will reach from Sine 38d. 28m. the Complement Latitude, to S. 36d. 20m. then the Extent from Sine 36d. 20m. to 70d. 31m. the Supplement of 109d. 29m. (the half Sum) to 180d. will reach from the Remainder 1d. 14m. to 158d. 40m. (upon the Lines of versed Sines) the Sun's Azimuth as above.

In South Latitude the Operation is the same with the two preceding Examples, only the Azimuth is found from the South.

After the same Manner you may find the Azimuth of any Star.

P R O B. IX.

The Latitude of the Place, the Sun's Declination and Altitude being given, to find the Hour of the Day.

Example. In the Latitude of 51d. 32m. North, suppose the Sun's Declination 23d. 29m. North, the Altitude 36d. 30m. in the Afternoon, and the Hour from Noon required.

The Rule. Take the Complement of the Declination, the Complement of the Latitude, and the Complement of the Altitude, add them together, and take the half Sum, subtract the Complement of the Altitude from the half Sum, and take the Remainder, then let down the Complement-

ment Arithmetical of the Sine Complement of the Declination, and Complement of the Latitude, and thereto add the Sines of the half Sum and Remainder; half the Sum of these four Logarithms, is the S.c. of the half Time required in Degrees and Minutes of the Equinoctial.

The Operation by Logarithm.

d.	m.				
66	: 31	Compl. Declination	— — — — —	S. Co. Ar.	0.037547
38	: 28	Compl. Latitude	— — — — —	S. Co. Ar.	0.206168
53	: 30	Compl. Altitude			
158	: 29				
79	: 14	Half Sum	— — — — —	Sine	9.992287
25	: 44	Remainder	— — — — —	Sine	9.637673
				Sum	19.873675
d.	m.				
30	9	S.c.	— — — — —	Half Sum	9.936837
30	9				

which doubled is 60 18, and reduced into Time, makes 4 hours 1 min. 12 seconds the Hour of the Day in the Afternoon.

But if it be in the Forenoon, 4 hours 1 min. 12 seconds subtracted from 12 hours, leaves 7 hours 58 min. 48 seconds for the Time in the Morning.

If the Declination had been Southerly, then instead of taking the Complement of the Declination to 90 deg. there must be 90 deg. added thereto, as in the second Example of the Eighth Problem; do the same when the Declination is North in South Latitude.

By Gunter.

The Extent of the Compasses from Radius S. 90d. to S. 66d. 31m. the Complement of the Declination, will reach from S. 38d. 28m. the Complement Latitude, to S. 34d. 40m. then the Extent from S. 34d. 40m. to the S. of 79d. 14m. the half Sum, will reach from S. 25d. 44m. the Remainder, to 60d. 18m. (upon the Line of Versed Sines) the Hour of the Day as above.

PROBLEM X.

Having the Latitude of the Place, the Sun's Right Ascension, with the Right Ascension, Declination, and Altitude of a Star given, to find the Hour of the Night.

Q

Example

Example.

In the Latitude 51 deg. 32 min. North, on the 18th of *January*, 1765, the Sun's Right Ascension is 20 hours 2 min. the Right Ascension of the *Lion's-Tail* was 11 hours 37 min. the Declination 15 deg. 54 min. North, the Altitude 30 deg. 30 min. to the Eastward of the Meridian, the Hour of the Night required.

The RULE.

Take the Complement of the Star's Declination, the Complement of the Latitude of the Place, and the Complement of the Star's Altitude; add them together, and take the half Sum, subtract the Complement of the Altitude from the half Sum, and reserve the Remainder; then set down the Complement Arithmetical of the Sines of the Complement of the Star's Declination, and of the Latitude of the Place, and thereto add the Sines of half the Sum and Remainder: Half the Sum of these four Logarithms, is the S.c. of half the Star's Distance from the Meridian.

The Operation by Logarithms.

d.	m.					
74	: 6	Comp. Star's Declination	_____	S. Co. Ar.	0.016942	
38	: 28	Compl. Latitude	_____	S. Co. Ar.	0.206168	
59	: 30	Compl. Star's Altitude	_____			
172	: 4					
86	: 2	Half Sum	_____	Sine	_____	9.998958
26	: 32	Remainder	_____	Sine	_____	9.650034
						Sum 19.872102
30d.	20m.	_____	S.c.	_____	Half Sum.	9.936051
30d.	20m.	_____				

which doubled is 60d. 40m. and reduced into Time, gives four Hours, two Minutes forty Seconds, or three quarters of a Minute.

By the Directions given in the Use of the Table of the Sun's Right Ascension, and of the Right Ascension and Declination of the fixed Stars, find the Time of the Star's coming upon the Meridian, if the Star be to the Eastward of the Meridian, subtract the Star's Distance from the Meridian in Time, from the Time of the Star's coming upon the Meridian
But

But if the Star be to the Westward of the Meridian, add the Star's Distance from the Meridian, to the Time of the Star's coming to the Meridian; the Sum or Difference is the Hour of the Night. In this Example, the Sun's Right Ascension 20 Hours 2 Minutes, subtracted from the Star's Right Ascension (with 24 Hours added thereto) 35 Hours 38 Minutes, leaves 15 Hours 36 Minutes, the Time of the Star's coming on the Meridian; from which subtracting 4 Hours, 3 Minutes, 40 Seconds, the Hour above found, leaves 11 Hours, 32 Minutes, 20 Seconds, the Hour of the Night.

Note farther, If the Star's Declination be South in North Latitude, or North in South Latitude, instead of taking the Complement of the Declination to 90 deg. there must be 90 deg. added thereto, as has been shewn in the Eighth preceeding Problem.

The Operation by Gunter's-Scale.

The Extent of the Compasses from Radius S. 90 deg. to the S. of 74 Degrees 6 Minutes, the Complement of the Star's Declination, will reach from S. 38 Degrees 28 Minutes the Complement of the Latitude, to the S. 36 Degrees 45 Minutes; then the Extent from the S. 36 Degrees 45 Minutes, to S. 86 Degrees 2 Minutes the half Sum, will reach from S. 26 Degrees 32 Minutes the Remainder, to 60 Degrees 40 Minutes (upon the Line of Versed Sines required;) with which proceed as has been directed to find the Hour of the Night.

Courses and Distance between some of the most eminent Places on the Coast of England, &c. As also the thwart Courses between the East Coast of England and Holland, the South Coast of England and France, and the West Coast of England and Ireland.

	Leag.
FROM Whitby to Tinnmouth, NW. by N. - - - - -	14
From Buchaness to Cathness, North West - - - - -	27
From the North Foreland to Flushing, East - - - - -	24
From the North Foreland to the Texel, NE. by N. half E. - - - - -	50
From the Spurn to the Texel, East by South - - - - -	55
From Tinnmouth to the Naze of Norway, NE. by E. - - - - -	118
From Tinnmouth to Holy Land. East by South - - - - -	110
From Tinnmouth to the Scauw, East North East - - - - -	110
From Yarmouth to the Texel, East by North - - - - -	34

	Leag.
From Newcastle to Maes Deep, ENE. ————	83
From Aberdeen to Maes Deep, South East ————	113
From the North Foreland to the Maes, ENE. ————	30
From Newcastle to the Fly, ESE. ————	90
From Scarborough to Holy Land, East Northerly ————	97
From the Start to the Eddystone, West half South ————	7
From the Land's-end to Scilly, WSW. three quarters West ————	9
From the Caskets to Blakeness, East North East ————	55
From Beachy to Blakeness, East a quarter North ————	15
From Dover to Diep, South half West ————	25
From the Lizard to Guernsey, East by South ————	35
From the Start to Seven Isles, South half East ————	25
From Scilly to Ushant, South East by South ————	35
From the Lizard to Ushant, South ————	29
From Hartland Point to the Island of Lundy, North ————	3
From Lundy to the Holms, East by North, Northerly ————	18
From Black Rock to Tuskar, East North East ————	3
From Cape Clear to Old Head, East by North ————	13
From Gresholm to Waterford, West by North ————	21
From the Land's-end of England to Tuskar, North by West ————	40
From the Land's-end of England to Waterford, NNW. ————	40
From Holy-Head in the Island Anglesea, to the Bar of Dublin, W. by N. ————	18
From Rochel to Black Rock, South by East ————	80
From the Land's-end of England to Cape Clear, NW. by W. ————	55
From the Land's-end of England to Old Head, North West ————	45

A TABLE of the Soundings coming into the Channel, respecting the Bearings and Distances of Scilly, Ushant, the Lizard, &c. with the Depth in Fathoms, and the various Sorts of Ground.

	Bearings.	Distance.	Lat.		Depth of W. f.	The various Sorts of Ground
			D.	M.		
Scilly.	South	5 50	20	50	Branny sand, like ground wheat	
	S S E.	5 50	12	45	White sand mixed with shells	
	S S E.	6		50	Coarse ouse	
	E S E.	6		53	Coarse sand, and fine red shells	
	E by S.	8 50	12	78	Ouse sand, Queens shells amongst it.	
	E by N.	7 49	15	72	Ouse like mustard seed with broken shells	
	E by N.	15 48	50	72	Pepper sand, black and yellow.	Scilly

Bearings	Dist	Lat.		Depth	The various Sorts of Ground.
		D.	M.		
Scilly.	E. by N	24	49	50	72 Black, white and red stones with ouse.
	E N E.	07	49	15	60 Some black sand
	E N E.	20	49	15	80 Rocky ground.
	E N E.	55		103	Fine white sand.
	NE by E.	22	49	10	85 Sand and ouse together.
	NE by E.	10	49	20	55 White and red sand mix'd with shells.
	NE by E.	50	49	50	100 White sand with ouse and nix.
	NE by E.	25	49	50	64 Branny sand with white and red shells.
	NE by E.	6	49	10	48 Black sand.
	NE by E.	13	49	43	65 Branny sand with some pieces of shells.
	North East	10	49	40	65 Branny sand, small stones, herring bones.
	NE by N.	10	49	20	57 Small red sand.
	N N E.	10	49	47	100 White sand then entering on the bank.
	N by E.	18			68 Red sand with black and white scollop shells.
	North	12	49	15	65 Broken shells with white and red sand.
	North	10	49	47	65 White sand on the East-part of the bank.
	N N W.	33	48	52	77 Red sand and shells amongst it.
	NW by N.	7	49	40	54 More shells, the <i>Lizard</i> NE. dist. 18 leag.
	North West	4	50	10	50 Branny sand with black and broken shells.
	North West	7	49	47	60 Stony ground.
	NW by N.	4	50	25	6 Red and black sand, with glistering shells.
	NW by W.	2			44 Shells and sand like points of needles.
	W by N.	13	50	25	63 Fine white sand with little ouse.
	West	21	50	8	66 Red and black sand with glistering shells
	W by S.	32	49	50	75 Fine white sand and glistering shells
	W by S.	3½			40 Like broken wheat or coarse Bran.
Uphant.	North	6	48	36	63 Full of small maes sand.
	N by E.	18	48	15	80 Round stones mixed with scollop shells
	NE by N.	11			60 Small beaten shells and hakes teeth.
	North East	29	48	50	85 Great and small pieces of cockle shells.
	North East	25	48	10	55 Grey and brown sand with white shells.
	NE by N.	7	48	30	68 White and grey maes sand.
	E N E.	14	48	36	68 Small shells and herring-bones.
	E by N.	25	48	30	85 White and grey sand with small red stones.
	East	18	49	00	70 Branny sand with some shells.
	East	6	49	00	65 Red sand, shells, things like needle points.
	East	15	49	15	70 Fine white sand.
	East	33	49	15	87 Dazling sand like barley-straw.
	East	4	49	10	60 Full of mass sand and broken shells.

E. by S

Soundings coming into the Channel.

	Bearings.	D. ft.	Lat.		Depth	The various Sorts of Ground.
			D.	M.		
Upbunt.	E by S.	14	48	56	63	Shells like Perriwinkles.
	E S E.	15	48	15	70	Shells grey and red pieces of Cockle shells.
	E S E.	12	49	20	68	Gross white sand with shells.
	E S E.	8	49	5	64	White shells and fine small stones.
	E S E.	6			61	Hakes teeth and shells like oatmeal husks.
	SE by E.	20	49	15	72	Great stones like pease and beans.
	SE by E.	9	49	15	65	Sand and some shells.
	SE by E.	37	48	30	65	James's shells.
	SE by E.	15	49	25	60	Small scollop shells. with some stones.

	Bearings.	D. ft.	Depth	The various Sorts of Ground.
Lizard.	North East	6½	13	Marshy shells and some scollop shells.
	NE by N.	10	52	Marshy shells and Hakes teeth.
	N N E.	9	50	Marshy shells like Oatmeal husks.
	N by E.	15	58	Marshy shells and Hakes teeth.
	North	1	39	Stones as big as Beans four Leagues off.
	North West	5	45	Grey sand like Oatmeal flour.
	North West	3	46	Marshy shells like small stones.
	W N W.	3½	47	Small shingly stones, and marshy shells.
	W by N.	4	40	Fine marshy shells like white stones.
	W by S.	3	41	Black gravelly Ground with small stones.
	NE by E.	12	57	Scollop shells.
Eddystone.	NE by E.	4	14	Great stones and rough Ground.
	North East	6½	50	Like Husks of Oatmeal and small stones.

Eddystone.	N. ½ a Mile	35	Dirty brown sand and Hakes teeth.
	W. 2 Miles	34	Dirty brown sand.
	S. 1 Mile.	26	Fine sand, and within this 28 and 30 fathom.

Start.	N by E. N. ly	8½	40	} Like the Dust of a Grindstone with Hakes Teeth and shells.
	NW. by W.	4½	43	
	NW. by N.	3	38	} Gravelly sand, small stones and shells.
	N by W W. ly.	12	38	
	NW by W.	14	43	} Redish shells mashed as if beat in a mortar, white sand and scollop shells.

Foreland

	Bearings.	Diff.	Depth	The various Sorts of Ground.
Foreland.	NE by E.	8	35	Small shingly stones as big as Pease.
	North	8	40	Streamy Ground with small stones.
	N by E.	5½	33	The same with some black sand.
	NE by N.	11	41	Fine sand and scollop shells.
	N N E.	10	40	Fine sand, scollop shells and small stones.
	NE by E.	28	27	Shingly ground.
	W N W.	2½	20	Small stones.
Needles	NE by E.	2	17	Great shingly Ground.
	NE half E.	2½	17	Small shingly Ground.
	North East	2	13	Rocky Ground.
Wight	N by W.	3½	20	All the Ground from St. Alban's to the East-end of the Wight is chalky and brown Sand.
	E by N.	4	21	
	N by E.	3	18	
Dunose.	W by S.	4	16	Rough Ground with some big stones.
	West	4	21	A kind of sandy fishy Ground.
	W N W.	8	33	Fishy Ground somewhat red, with stones as big as Pease, and small Beans.
	N by W.	6	26	

Directions to sail into some of the Principal Harbours on the Coast of England.

Directions to sail into Scilly.

SCILLY is divided into divers Islands; along the West-side lieth a great many Rocks. There are several Channels through which to go in, but the Southermost called St. Mary's Sound is the best, being a fair opening of the Channel, but near the Midst lie two sunken Rocks, which in foul Weather the Sea may be seen to break over: It is best to leave them on the Larboard-side going in, and on the Starboard-side coming out. Go as near the Starboard-shore, as that a Stone might almost be thrown on it. And when you are within the Point, luff up round, and come to an Anchor in Sight of the Houses; or when the Town is brought open to the Valley, leave two-thirds of the Harbour on the Larboard-side.

To sail into some of the Principal Harbours

Directions to sail into Mount's-Bay.

To Anchor in Gover's-Lake.

There are two sunken Rocks, which lie right in the Way of going into the Lake, about a Mile without your anchoring Place; these Rocks lie NNW. and SSE. about half a Mile in length, to shun which, observe the following Directions.

If the Wind is in the Eastern Hank, give the Eastern Shore about a League's Birth, and keep *St. Paul's Church* wholly in Sight above the Hill, till you bring a Church on the Eastern Shore a Sail's Breadth to the Northward of *St. Michael's Mount*, then bear away for the Lake Hill, keeping your Mark till you run *St. Paul's Church* down under the Hill, then let go your NE. Anchor, and carry the other to the SW. and you will be well moor'd, and in good fine Ground, all Sand.

You may come in, keeping one half of the Church above the Hill, you'll go clear of them to the Eastward, and when it shuts down you are to the Westward of them, and when upon them, the Top of the Tower and a long Hedge is in one, about 6 or 7 Feet at low Water.

If the Wind is in the Southern or Western Hank, keep the Land on board, which is bold; you may go within a Quarter of a Mile of the Point; run till you shut *Mousethole Island* in, and *St. Paul's Church* down under the Land well, then come too with your SW. Anchor, then carry the other to the NE. you will be well moor'd in fine Ground as before-mentioned: Be sure to have the Church on the Eastern Shore a Sail's Breadth to the Northward of the Mount.

If your Ground Tackling is good, your Anchors will never start, the Wind at SSE. or SE. heaves in a great Sea, and raises a great Ground Sea when it blows hard; the harder it blows you have a stronger Outset in your Favour; there is no Tide, you always ride Head to Wind, your Anchors will sooner start with the Wind to the N. or NW. because the Ground goes out with a little Descent.

To sail into Foy.

Foy may be very easily known, lying in between two high Lands; on the West-side going in, is an old Church and Castle, and on the East-side the Ruins of an old Church, as you may see by the making of it in *Capt. Collin's Draught of Foy*. The going in is a Cable's Length over from Side to Side, and no Danger; when you are in you may Anchor before the Town, or run up above the Town. In the Time of the *Dutch War*, in the Year 1666, there was above sixty Sail of *Virginia Ships* put into this Harbour. This Place lieth NE. and SW. in and out, which makes it a better Out-let to the Westward than *Plymouth* or *Falmouth*. And whereas

it hath been reported to be a Bar Harbour, and that you cannot enter till half Tide, I do assure you that there is no less than three Fathom at Low-water at a Spring Tide; here you may lie ashore to wash, tallow, or stop Leaks; the Spring-Tides rise and fall 16 or 17 Feet, and it is High-water here at Full and Change a Quarter past Five. There is good Anchoring in the Road without the Harbour, from 5 to 10 Fathom Water, but without that Depth foul Ground.

To sail into Falmouth.

Upon the West Point of the Haven of *Falmouth*, standeth a Castle on the high Land, called *Pendennis* Castle. In the Entry nearest the said West-side, lieth a Rock above Water, you may sail in on either Side of it, on the Inner-side of the East Point lie also some Rocks off the Shore; on the East-side is deepest Water, and most Room, therefore in going in, give the East-Point a large Birth; there will be 7 or 8 Fathom. Keep the said Shore till you come within *St. Maud's* Castle; which when it bears East, there will be 16 or 17 Fathom, but half the Harbour over towards the *Smithick* is but 4 or 5 Fathom; observe in going in to keep the *Manacles* open and shut on the Point of *Falmouth* Castle, and so it must be kept till you shut the Church over *Penny Comquick*, into the North East-end of the *Smithick*, and so bear over to *St. Maud's*, and ride with the Castle East, laying one Anchor in 18 Fathom, and the Westermost Anchor in four Fathom, as shall be most convenient.

To sail into Plymouth.

At the Eastermost Point of *Plymouth* Sound lieth a high round Rock called *Mewstone*; between it and *Ramhead* lieth the said Sound, North North East, being round and deep.

A little to the Northward of *Ramhead*, is a fair sandy Bay, where is good Anchoring close under the Land, in 9 or 10 Fathom: South a little Easterly from *Ramhead*, lies a Rock above Water called the *Eddystone*, (on which is erected a Light-house) the Point of *Plymouth* lies from it N. by E. distant about 4 Leagues.

In the Sound, by the Land of *Plymouth*, lieth an Island called *St. Nicholas* or *Drake* Island, which is joined to the West-side with a Range of Rocks under Water, so that you may sail along to the Eastward of it.

To sail into Catwater.

To sail into *Catwater*, run in between the Island and the Point on the East-side of the Land of *Plymouth*, till *Catwater* open on the Starboard-side, then go in to the Eastward between the Point of *Plymouth*, and the
R
Point

To sail into some of the Principal Harbours.

Point, on the Starboard-side, leaving most Part of the Channel on the Starboard-side, until you come within the Point, and anchor there right against the high steep Northern Land; there is at Low-water, with extraordinary high Tides 4 and 5 Fathom.

In sailing into *Catwater*, be sure to give a good Birth to the Southern Point of the Entry, for there lies off the said Point a Ledge of Rocks under Water, about two Cables Length off from the Land. Upon the Point of the Ledge lies a Buoy, where is about twelve Feet Water at half Flood, which Buoy must be left on the Starboard-side going in, and when *Catwater* is altogether open you may run in to the Eastward, leaving in the Entry of the Harbour two-thirds of the Channel on the Starboard-side, as afore said, because the South-shore is somewhat flat off, there lying a sandy Bank, which reaches to the Second Point of the South-shore of *Catwater*.

A little to the Eastward of *Drake Island* lies a Rock under Water, upon which at Low-water it is not deeper than two Fathom. To sail within the Land you may go to the Eastward or Westward of the Rock, as Occasion serves.

To sail into Dartmouth.

Dartmouth hath a narrow Entrance lying in between two high Lands: On each Side of the Haven standeth a little Castle; on the West-side is a Church on the high Land, called *St. Patrick's Church*. To sail in, coming from the Westward run in along by the West Land, so far to the Eastward until the Key of the Village (on the East-side of the Haven) be brought in the midst of the Entry of the Haven between the two Lands: It's convenient to have a Boat ready (if any Gust of Wind should come from the high Land) to tow in. Being come in, edge over to the West-side before the Brewhouse, and anchor there in 10 or 11 Fathom, or before the Village to the East-side at Pleasure; At the East-side lieth a sunken Rock, to avoid which steer in with *St. Patrick's Church*, and do not bring the Village which standeth on the West-side of the Harbour, without the said Church, but keep the outer House of the said Village in the East-side of the Chapel, always in Sight, without the Bulwarks on the North-side by *St. Patrick's Church*, then there is no Danger of the Rock, in the Range by the North Point. Between *Dartmouth* and the Start, nearest to *Dartmouth*, standeth a white square Steeple, called *Fackman*, which is a very good Mark to know *Dartmouth* by.

To sail into Torbay.

Being the West Point of the *Berry S.* by E. or SSE. from you; and anchor there in 7 or 8 Fathom, where you shall be landlock'd for a S. and SW

SW. Wind. At the North East-end of the Bay is also a Tide Haven called the *Tormain*; before it is very good Anchor Ground in 4 or 5 Fathom, according as you desire to be nearer or further from the Shore.

Directions for sailing in at the East-end of the Isle of Wight to Portsmouth Harbour, and also to Hampton.

If you come from the Eastward with a Northerly Wind, bound into the *Isle of Wight* or *Portsmouth*; after you come to the Westward of the Shoal called the *Ower*, hawl in North West with *St. Hellen's Point*; but do not hawl too much to the Northward, for there lies a Bank off of *Langstone Haven* to the Eastward of the *Horse*, that hath not above 13 Feet on it at Low-water; but keeping in 7 or 8 Fathom, carrieth you clear without it, and will bring you to the SE. End of the Sand called the *Horse*. *St. Hellen's Church* being SW. by W. from you, you may run in 5 Fathom, and when you have brought the Westermost great white Patch, or Chalk upon *Po't Down* (which is the high Land to the Northward of *Portsmouth*) a Ship's Length to the Westward of *South-Sea Castle* that stands upon the Beach, then you may luff up without Fear: Being then to the Westward of the *Horse*, and steering with that Mark, it will lead you in along the *Horse* unto the Beach, and so into the Harbour of *Portsmouth*, keeping along close by the Shore, until you come by the Town-wall's End, and there you must bear off a little for a Flat, that lieth off from the Shore, this is for an Easterly Wind. But if you intend for *Stokes-Bay*, when you have brought the Fire Beacon on *Brown-Down*, (which is to the WNW. of *Hastlewood Point*) within a Ship's Length without the said Point, then you may bear to the Westward along the Outside of the *Spit*, which is the Shoal on the West-side of the Entrance of *Portsmouth Haven*.

If the Wind be Westerly or Southerly, and you are coming from the Westward, and design for *St. Hellen's Road* or *Stokes-Bay* (from *Dunnofs*, to *St. Hellen's Point*, the Course is NE. by N. and NNE.) but borrow no nearer to *St. Hellen's* than 6 or 7 Fathom, for the Spit lies off a great Way; but if it be clear Weather, that you may keep *Sand-Down Castle* open of the *Culver Cliff*, that Mark will lead you without the *Spit* of the Point; steer along in this Mark until you open *St. Hellen's Church* about two Ship's Length open of the *Red-Cliff* within *St. Hellen's Point* or *Port-Sea Castle* to the Eastward of *South-Sea Castle*, then are you clear of the Point, and may steer to *St. Hellen's Road* NW. and having brought the Point S. by W. or between that and the S. by E. you may anchor in 7 or 8 Fathom Water on very good Ground.

Note, That you have no good clear Ground all along the Island, until you have opened *St. Hellen's Church*, as aforesaid, and have brought the Point to bear from you SSW.

From *St. Hellen's Point*, to go between *No-Man's-Land* and the *Horse*, the direct Course in, is NW. by N. and NW. but you have no Shoaling upon the SW. side of *No-Mans-Land*, for you have 16 Fathom, and the next Cast but 3; but at the *Horse* you may stand into 10, 9 or 8 Fathom: If the strong Tide be spent, and smooth Water, you will have a great washing of them by the Overfall of the Water; but especially on *No Man's-Land*, if it be clear Weather, there are two very good Marks to lead you in, which are as follow; keep the two Windmills on the *Downs* on the *Isle of Wight*, that they may be seen clear all over the Trees between you and them, but no more above them than even clear; this Mark will lead you in, and so up all along the Island without some middle Ground that lieth SSW. off the Point *No-Man's-Land*.

Also from *St. Hellen's Point* (if it be clear Weather that you can see it) there is a direct Mark, viz. a Part of an Old Castle formerly called *Hastewood Castle*, standing on *Gilkicker Point* (which is kept white,) keep *Gosport Church* and that Castle in one, or this Castle in the Middle of the Wood about the Church, which sheweth with a Valley like a Saddle, and so you may run directly in without Fear. Or if the Wind be so that you are forc'd to turn in, then you may run the said Mark within two Sail's Breadth of each End of the Wood. In the Middle of the Channel is about 11 Fathom Water; and if you bring the said Mark right under the North End of the Wood, you shall run in a middle Ground near the *Horse*, that hath not above 10 Feet on it at Low-water, and hard Sand.

Being in *Yarmouth Road*, and you would sail out of the *Needles*, steer away from *Hurst Castle*, which Place is very steep; being past the Castle, steer away for the *Needles*, which are sharp white Rocks; giving a Birth to some Rocks that lie off from the Island-side in the Fair-way, between the Castle and the *Needles*, you must keep close to the *Needles*. The Tide of Ebb setteth on the *Shingles*, which are hard Stones. The Flood setteth on the *Needles*.

To sail into the *Needles*, you will know the going in by the high white Land which is the West-end of the *Isle of Wight*; run boldly in with the Land, till you see the *Needle Rock*, and then keep close to it, observing the Tides, as in the Directions coming out. *Note*, That there is a strong *Indraught* that sets in at the *Needles*, and into *Pool*; which *Indraught* hath haul'd many Ships into *Freshwater Bay*. Keep in 25 and 30 Fathom, and you need not fear the *Indraught* of the *Wight*.

To sail within the Wight in thick Weather.

To sail between the Main and the *Wight* in thick Weather, borrow in 7 Fathom off *St. Hellen's*, and steer NW. by N. and NNW. from *St. Hellens Point*,

Point, till you have 12 Fathom, and then steer more Westerly, as you find the Depth; come no nearer *No-Man's-Land* than 9 or 10 Fathom; in that Depth you may keep along the *Wight* Side, if the Wind be Southerly; but if it be large keep in 14 or 15 Fathom, which is a good Birth from both Sides, and so steer W by S. and WSW. as you find the Depth until you come to *Cowes*. Note, That being about *Stoke's-bay*, there will be less Water; if you go nearer to *Cowes*, there you may anchor in 12 or 14 Fathom, in the midst of the Channel, where is oazy Ground.

Directions for Dover-Road.

The best Ground in *Dover-Road* is with the *Whiteway*, to the NW. of *Dover-Castle*, or between that Hill that comes from St. James's Church, which is a flat Steeple at the North-end of *Dover* Town, for a thwart Mark, and so in what Depth you please, from 12 to 14 Fathom. Thwart of *Folkstone* in 12 or 14 Fathom is very good Ground.

Directions to sail from the North-Foreland through the Gulls in the Night.

If your Ground Tackle should fail in the Night riding at the *North-Foreland*, as very often hath happened, and you cannot weather the *Foreland*, weather the *Northsand head*; if you can see but the *North-Foreland* Light, when that Light-house bears NW. or NW. by N. then bear over into 8 or 9 Fathom, and being in that Depth (steering SSW.) you may be sure it will carry you directly through with the *Brake*, by keeping your Lead carefully, and borrowing no nearer the *Brake* than five Fathom, nor going without 9 Fathom, or 9 and a half, as you have the Tide under you; this Course will lead you through without Danger.

Directions for the North-end of the Goodwin, for such as sail from the North-Foreland to the Southward in the Night.

If you be at the *North-Foreland*, bound for the *Downs*, and the Tide falls out too early or too late, to turn into the *Downs* with the Wind at SW or SSW. take the following Directions.

If it be in the Morning before Day, then be sure to weigh Anchor in convenient Time, to be at the *Northsand-head* at the turning of the Tide to the Southward. From the *Foreland* you may steer out with a Flood Tide, SE. by E. and SE. or keep the Light of the *North-Foreland* NW. by N. this Course will lead you out. But for the more Certainty, be sure keep the Lead well, and then you may borrow off and on with the foresaid Winds in 7 or 8 Fathom. and steering out with the foresaid Course, you shall find the Depth suddenly change to 15 or 20 Fathom: then

then you may hawl close up to the Southward, along the Back of the *Goodwin*, the Eastermost-side of which lies SSW. and NNE. 12 or 14 Fathom, and is not above a Musket-shot from the Sand. But if it be in the Day Time, and the Wind blows so hard that you cannot well tack to run through the *Gulls*, then the Marks to carry you out at the *North-sand-head*, is a flat Church upon the *Foreland*, called *St. Peter's*, a Ship's Length to the Northward of *Broad-stairs Pier-head*; or borrow upon the Sand by the Lead as aforesaid, and to taking the first of the Tide without the Sand, you may stand to the South Eastward, till the *South-Foreland* bears W. by S. then cast about, and you shall weather the *South-sand-head*, and be in the *Downs Road* as soon as any other Ship that parted with you at the *Foreland*.

Directions for sailing over the Spits, the Wallet, and by the Naze into Harwich.

Sailing down the *Swin* or *King's Channel*, and that you would sail into *Harwich* over the Buoy of the *Spits* into the *Wallet*, you must observe your Tides, for at the *Spits*, the Buoy lieth in 5, 6 and 7 Feet Water at Low-water, and the Passage often alters, sometimes more Water, sometimes less. The Buoy lieth on the West-end of the *Gunfleet-sand*, and the East-end of the *Buxey*, bearing from a flat Steeple, called *Great Holland Church*, South by East. Being over the *Spits*, you come into the *Wallet*, where is very good Anchoring in five, six, seven and eight Fathom Water; the Sands lying without, makes it a most excellent Road. There is a good and deep Channel to sail in at the *Wallet*, between the *Gunfleet* and the *West Rock*, but 'tis seldom used. Being over the *Spits* in the *Wallet*, steer away for the *Naze*, which may be known by the Trees, and a House that standeth on it, keep about half a Mile, or a Mile off from the *Naze*, to avoid the Stone Bank, which hath but 5 Feet Water on it at Low-water; and lieth from the *Naze* Trees E. by N. About a Mile and an half from the *Naze Point*, there is about 8 or 9 Feet Water between it and the *Naze* at Low-water; Keep *Payn's Trees*, that lie a little to the Southward of *Harwich*, open and shut with *Harwich-Cliff*, and this Mark will carry you on the Stone Bank, and the Trees on the *Cork-land*, just open of the *Naze-land*, will carry you on the Bank also. There is a good leading Mark to carry you between the *Naze* and the Stone Bank, which is *Harwich Steeple*, on *Harwich Beacon Cliff*, which will also carry you between the *Pye-sand* and the Ridge, into the *Rowling-Grounds*, where the Ships anchor in 3 or 4 Fathom at Low-water. The Mark to anchor in the best off the *Rowling-Ground*, is to bring *Harwich Windmill* two Sails Breadth open of *Harwich-Cliff*. And to sail from the *Rowling-Ground* to the *Naze*, keep *Payn's Trees* open off *Harwich-Cliff*, till you bring the
Naze

Naze to bear SW. then keep *Harwich Steeple*, on the *Beacon Cliff*, to run within the *Stone Bank*. There is a *Channel* to sail from the *Naze* between the *Cork Sand* and the *Ridge*, keeping the *Naze Trees* SW. sailing down NE. between the *Cork* and the *Ridge*, in 5, 6 and 7 Fath. water. And when you have brought *Harwich Steeple* on the *Brewhouse* that lieth to the Northward of *Languard Fort*, then are you clear of the *Cork Ledge*; this *Channel* is much used by the *Light Colliers* going to the Northward.

Being in the *Rowling Grounds*, and that you would sail into *Harwich Harbour*, keeping close by the *Andrews*, which is a *Sand* that lieth off from *Languard Fort*, and is steep too on the West-side; The *Tide* of *Ebb* runneth strong over the *Andrews*, the first half ebb, of which you must have a *Care*. This *Sand* is dry at *Low-water*; keep close by the *Beach* of *Languard Fort*, to avoid the *Altar*, which is a small stony Shelf that lieth right West from *Languard Fort*, about a *Cable* and an half's Length from the *Beach* at the *Fort*, on which is but 5 or 6 Feet at *Low-water*. You may sail to the Westward of it, between it and *Harwich Cliff*, according as the *Tide* is up, and what *Draught* of water your *Ship* draweth: But if you should want to go into *Harwich* at *Low water*, and your *Ship* draweth above 15 Feet, you may stay for the *Flood* to have Water over the *Glutton*, which is a narrow *Ridge* that stretcheth off from the *Beach* thwart the *Channel*, a little within the *Brewhouse*, that is to the Northward of *Languard Fort*. Being past the *Glutton*, you must keep close to the *Beach* to avoid the *Gristle*, that lieth in the Middle between *Harwich* and the *Beach* of *Languard Fort*, on which is but three Feet at *Low-water*, there is a small *Channel*, between the *Gristle* and the *Guard*, of nine Feet at *Low-water*, but when you have opened *Dover Court Church* off *Harwich Town*, then you are clear of the *Gristle* and the *Guard*, and may anchor before the *Town* of *Harwich* in five Fathom water, or run into *Ipswich Water* and anchor; this is a very safe Harbour, and if a *Ship* should chance to blow a-shore she can take no Harm, the *Shore* being soft and easy. The *Spring Tides* rise 15 and 16 Feet, and the *Neap-Tides* 10 and 11 Feet.

Directions to sail into Harwich through the Sled-way.

Being at the *Buoy* of the *Spits*, and you are not minded to sail over the *Spits*, then keep down by the *Gunfleet-sand*, in 7 and 8 Fathom water, till you come within Two Miles of the *Buoy* of the *Gunfleet*, and then come no nearer than 9 Fathom Water, for there lieth off a *Spit* ESE. from the *Sand* about a *Cable's* Length; to the Eastward of this *Spit* is a small *Swatch* through the *Sand*, into which, and *Goldmore's Gât*, the *Tide* of *Flood* setteth strong into the *Wallet*; of which you must have a
Care

Care when you come near it, especially in little Winds or Calms, you may be hauled on the *Gunfleet-sand*; this Sand lieth NE. and SW. and drieth in several Places: The Buoy of the *Gunfleet* beareth from the *Naze* SE. (by E. Easterly; you may stand into 7 or 8 Fathom along the Side of the *W. Rock* into the *Sledway*, keeping *Balfey Church* N. by W. and NNW. till you bring *Harwich Steeple* on the *Brewhouse* (that lieth to the Northward of *Languara Fort*) which will carry you clear of the *Cork Ledge*, on which is two Fathom and an half at Low-water, and then stand to the Westward, and keep *Orford Church* and *Castle* open of *Balfey Church* a Sail's Breadth, 'till you have the Lights together, keep them so till you are past the *Andrews*, and then follow the former Directions for sailing into *Harwich*; you may stand in upon the *Platters* into five Fathom, on which Sand is but two and three Feet at Low-water; the *Ridge* hath seven Feet at Low-water; a great Part of the *Cork Sand* drieth at Low-water; and lieth in Length NE. and SW. about two Miles and a half long, and a Mile broad: *West Rocks* lie in Length NE. and SW. about three Miles, and two Miles broad, and drieth in several Places, full of Banks and Swatches, the Ground rocky and stony in many Places; there is a small narrow Channel between the *West Rocks* and the *Cork*.

For the more particular Directions for sailing into these and other Harbours in *England, Scotland, Holland, Normandy, Bretagne, &c.* see the last Edition of the *COASTING-PILOT*, newly Corrected, and Reprinted for J. MOUNT, and T. PAGE, on *Tower-Hill, London* with many Additions.

FINIS.